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SMITHSONIAN

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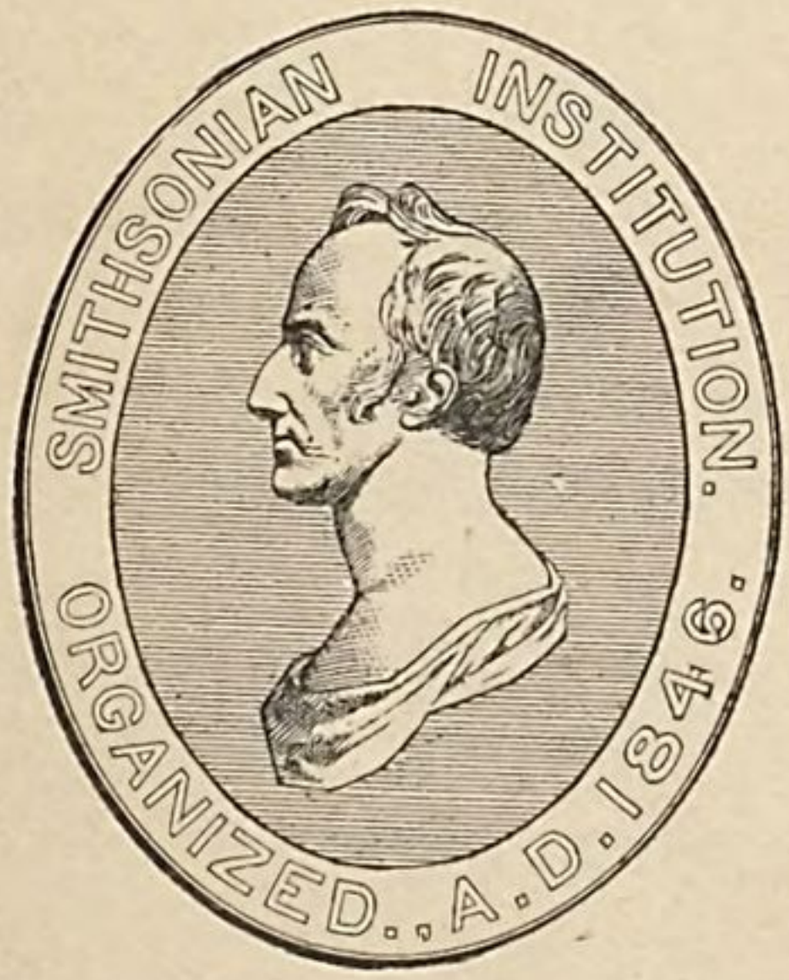

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Department of the Interior:

U. S. NATIONAL MUSEUM.

BULLETINS

OF THE

UNITED STATES NATIONAL MUSEUM.

VOLUME III.

(No. 16.)

PUBLISHED UNDER THE DIRECTION OF THE SMITHSONIAN INSTITUTION.

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1882.

TABLE OF CONTENTS.

SYNOPSIS OF THE FISHES OF NORTH AMERICA. By DAVID S. JORDAN AND CHARLES H. GILBERT. 1882. 8vo., pp. 1074. *Bulletin of the National Museum, No.* 16.

Department of the Interior:

U. S. NATIONAL MUSEUM.

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This work is the sixteenth of a series of papers intended to illustrate the collections of natural history and ethnology belonging to the United States, and constituting the National Museum, of which the Smithsonian Institution was placed in charge by the act of Congress of August 10, 1846.

It has been prepared at the request of the Institution, and printed by authority of the honorable Secretary of the Interior.

SPENCER F. BAIRD,
Secretary of the Smithsonian Institution.

SMITHSONIAN INSTITUTION,
Washington, May 20, 1882.

SYNOPSIS

OF THE

FISHES OF NORTH AMERICA.

BY

DAVID S. JORDAN

AND

CHARLES H. GILBERT.

WASHINGTON:
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1882.

PREFACE.

In this memoir we have endeavored to give concise descriptions of all the species of fishes known to inhabit the waters of North America, north of the boundary between the United States and Mexico.

The classification which we have adopted is essentially based on the views of Professors Gill and Cope, who have, it seems to us, been more fortunate in reflecting nature in their groupings of the fishes than have any of the European systematists. In our arrangement of the families and genera, we have endeavored to avoid, on the one hand, unnatural associations, and on the other, subdivision beyond reasonable limits. Genera to which we have been unable to give precise definition have been rarely adopted.

The rules of nomenclature generally recognized by naturalists, and recently admirably formulated by Mr. W. H. Dall, have been followed without deviation, except such as may be due to ignorance of all the facts in any particular case. Most of the present confusion in nomenclature is due to the neglect of established rules, and the only way out of this confusion is through the rigid enforcement of these rules. There is little hope for uniformity in nomenclature so long as individual preference or caprice is allowed to affect it.

We are under obligations to Prof. Spencer F. Baird, to Prof. G. Brown Goode, and to Dr. Tarleton H. Bean, for many aids, especially in connection with our use of the specimens in the United States National Museum. To Dr. Bean, in particular, we have been indebted for help of various sorts, including many unpublished notes. To Dr. Theodore Gill and to Prof. E. D. Cope, we are indebted for numerous aids and suggestions. Mr. Samuel Garman, of the Museum of Comparative Zoology, has given us considerable assistance on the Elasmobranchs. Mr. Chas. L. McKay, of the United States Signal Service, has revised

our account of the *Centrarchidæ*. Prof. S. A. Forbes, of the Illinois Laboratory of Natural History, has furnished numerous notes on the *Percidæ* and *Cyprinidæ* of Illinois. Prof. Felipe Poey, of Havana, has given valuable information in regard to the fishes of the Florida Keys. Professor O. P. Hay, of Butler University, has furnished us manuscript descriptions of species new to science. Miss Rosa Smith, Mr. Joseph Swain, and especially Mrs. Susan B. Jordan, have given important personal assistance in the verification of the descriptions in our manuscripts.

Finally, we may refer to the early encouragement received from Dr. Elliott Coues, whose advice and example led us to undertake to do for American Ichthyology, so far as lay in our power, what Coues' "Key to North American Birds" has done for American Ornithology.

A Bibliography of North American Ichthyology is soon to be published by Professor Goode. We have therefore not attempted to give a list of the works consulted by us. We have endeavored to examine everything pertaining to American Ichthyology.

Under the head of each species, enough synonymy has been given to connect this work with other descriptive works, and no more. Reference is made to the original description of each species, to the descriptions in Dr. Günther's "Catalogue of the Fishes of the British Museum," and to other works in which special information is given or in which some name different from the one adopted by us is employed.

This work was first prepared for the press in 1879, during which year a portion of it was printed. Since then the printing has been several times interrupted, chiefly by the absence of the authors while engaged in field-work. It was finished in September, 1882. The manuscripts unprinted have been from time to time revised, and each part has been brought up to the date of finally leaving our hands. The fact that the printing has extended over more than three years,—three of the most active years in the history of American Ichthyology,—will account for some discrepancies between the first and last parts of the work. In the Addenda, we have included the species which have been described since the printing of the accounts of the families to which they respectively belong.

DAVID S. JORDAN.
CHARLES H. GILBERT.

INDIANA UNIVERSITY,
Bloomington, Ind., September 14, 1882.

NOTE.—In our descriptions the *length* of the fish is always measured from the tip of the snout to the end of the last vertebra: the caudal fin being *not* included. The expressions "head 4" or "depth 4" mean that the length of the head, in the one case, or the greatest depth of the body, in the other, is one-fourth of the length of the fish. "Lat. l." indicates the number of scales in the lateral line; when, however, the number of transverse series of scales between the head and the caudal fin is different from the number pierced by the lateral line we have usually given the former number. The measurements given in the text are intended to apply to mature fishes. Young fishes have usually the depth less, the head larger, the mouth smaller, and the eye larger, than adult examples of the same species.

In the synonymy of any species, where an author quoted has used the name adopted by us, that name is not repeated. Descriptions not taken from specimens, or at least not verified by us, are, in all cases, credited to the author from whom they have been copied.

TABLE OF CONTENTS.

	Page.
Class I. Leptocardii	2
Order A. Cirrostomi	2
Family 1. Branchiostomatidæ	2
1. Branchiostoma Costa	3
1. lanceolatum Pallas. (Addenda)	3, 57, 867
Class II. Marsipobranchii	3
Order B. Hyperotreta	4
Family 2. Myxinidæ	4
2. Myxine L	4
2. glutinosa L	5
Family 2 (*b*). Bdellostomatidæ. (Addenda)	967
3. Polistotrema Gill. (Addenda)	5, 867
3. stouti Lock	6, 57, 867
Order C. Hyperoartia	6
Family 3. Petromyzontidæ	6, 867
3 (*b*). Entosphenus Gill. (Addenda)	7, 57, 868
4 (5, 6). tridentatus Gairdn	7, 57, 868
4 (5). Ammocœtes Dum	9, 867
§ *Lampetra* Gray	7, 867
7. plumbeus Ayres	8, 867
7 (*b*). aureus Bean. (Addenda)	868
§ *Ammocœtes*	9
8. niger Raf	9, 867
8 (*b*). appendix Dek. (Addenda)	868
6 (7). Petromyzon L	10, 867
§ *Ichthyomyzon* Grd	9, 867
9. argenteus Kirt	10, 867
9 (*b*). hirudo Grd	868
10. castaneus Grd	10, 868
§ *Petromyzon*	867
11. marinus L.	11, 868
12. dorsatus Wild. (Addenda)	11, 868
Class III. Elasmobranchii	12
Subclass Selachii	12
Order D. Squali	12
Family 4. Scymnidæ	13
8. Echinorhinus Blainv	14
13. spinosus Gmel	14
9. Somniosus Le S	14
14. microcephalus Bloch	15
Family 5. Spinacidæ	15
10. Centroscyllium M. & H	16
15. fabricii Reinh	16
11. Squalus L	16
16. acanthias L	16
12. Centroscymnus Boc. & Cap	17
17. cœlolepis Boc. & Cap	17

Class III. Elasmobranchii—continued. Page
Subclass Selachii.
Order D. Squali.
Family 6. Scylliidæ. (Addenda) 17, 58
13. Ginglymostoma M. & H 18
18. cirratum Gm 18
13 (*b*). Scylliorhinus Blainv. (Addenda) 58, 869
§ *Catulus* Smith. (Addenda) 869
18 (*b*). ventriosus Garm. (Addenda) 59, 869
18 (*c*). retifer Garm. (Addenda) 869
Family 7. Carchariidæ. (Addenda) 18, 870
14. Mustelus Cuv 19
§ *Mustelus* 59
19. canis Mitch. (Addenda) 19, 870
§ *Pleuracromylon* Gill. (Addenda) 870
20. californicus Gill 20, 59, 870
15. Triacis M. & H 20
§ *Triacis* 20
21. semifasciatus Grd 20
§ *Rhinotriacis* Gill. (Addenda) 59, 870
22. henlei Gill 20, 870
16. Galeorhinus Blainv 21
23. zyopterus J. & G. (Addenda) 870
17. Galeocerdo M. & H 21
24. tigrinus M. & H 21
18. Carcharias Raf. (Addenda) 22, 872, 967
§ *Carcharinus* Blainv 22
25. glaucus L 22
§ *Platypodon* Gill. (Addenda) 967
26. obscurus Le S 22
§ *Eulamia* Gill 22, 60
26 (*b*). platyodon Poey. (Addenda) 872
27. cæruleus Dek. (Addenda) 872
27 (*b*). lamiella J. & G. (Addenda) 60, 873
19. Isogomphodon Gill 23
28. limbatus M. & H 23
19 (*b*). Hypoprion M. & H. (Addenda) 61
28 (*b*). brevirostris Poey. (Addenda) 61
21. Scoliodon M. & H 24
30. terræ-novæ Rich 24
Family 8. Sphyrnidæ 25
22 (23). Sphyrna Raf 26, 874
§ *Reniceps* Gill 25
31. tiburo L 25, 874
§ *Sphyrna* 26
32. zygæna L 26
Family 9. Alopiidæ 26
24. Alopias Raf 27
33. vulpes Gmel 27
Family 10. Odontaspididæ. (Addenda) 27, 62
25. Odontaspis Ag. (Addenda) 27, 874
§ *Eugomphodus* Gill 27
34. littoralis Mitch. (Addenda) 27, 874
Family 11. Lamnidæ 28
26. Isurus Raf 28

Class III. Elasmobranchii—continued. Page.
Subclass Selachii.
Order D. Squali.
Family 11. Lamnidæ.
§ *Isuropsis* Gill 28
35 (36). dekayi Gill 28, 874
27. Lamna Cuv 29
37. cornubica Gmel 30
28. Carcharodon Smith 30
38. carcharias L. (Addenda) 30, 875
Family 12. Cetorhinidæ 30
29. Cetorhinus Blainv 31
39. maximus Gunner 31
Family 14. Cestraciontidæ. (Addenda) 32, 62
31. Heterodontus Blainv. (Addenda) 32, 875
§ *Gyropleurodus* Gill 32
41. francisci Grd 33, 875
Family 15. Notidanidæ. (Addenda) 34, 62
31 (*b*). Hexanchus Raf. (Addenda) 62
41 (*b*). corinus J. & G. (Addenda) 62
32. Heptranchias Raf. (Addenda) 34, 62
§ *Notorhynchus* Ayres 34
42. maculatus Ayres (Addenda) 62
Family 16. Squatinidæ 35
33. Squatina Dum 35
43. angelus Dum 35
Order E. Raiæ 36
Family 17. Pristidæ 36
34. Pristis Lath 37
44. pectinatus Lath. (Addenda) 37, 875
Family 18. Rhinobatidæ 37
35. Rhinobatus B. & S 37
§ *Rhinobatus*. (Addenda) 876
45. productus Ayres 38, 876
45 (*d*). lentiginosus Garm. (Addenda) 65
§ *Zapteryx* J. & G. (Addenda) 876
45 (*b*). exasperatus J. & G. (Addenda) 63
§ *Platyrhinoidis* Garm. (Addenda) 876
45 (*c*). triseriatus J. & G. (Addenda) 64
Family 19. Torpedinidæ 38
36. Torpedo Dum 38
46. occidentalis Stor 39
47. californica Ayres 39, 876
36 (*b*). Narcine M. & H. (Addenda) 877
47 (*b*). brasiliensis Olfers. (Addenda) 877
Family 20. Raiidæ 39
37. Raia L 39
48. erinacea Mitch 40
49. ocellata Mitch 40
50. radiata Donov 41
51. eglanteria Lac 41
52. lævis Mitch 42
53. granulata Gill 42
53 (*b*). ornata Garm. (Addenda) 877
53 (*c*). plutonia Garm. (Addenda) 878
54. binoculata Grd. (Addenda) 42, 878

Class III. Elasmobranchii—continued. Page.
Subclass Selachii.
Order E. Raiæ.
Family 20. Raiidæ.
55. rhina J. & G 43
56. inornata J. & G. (Addenda) 43, 878
57. stellulata J. & G 44
57 (*b*). parmifera Bean. (Addenda) 878
Family 21. Trygonidæ 45
38. Urolophus M. & H 46
58. halleri Coop 46
39. Pteroplatea M. & H 46
59. maclura Le S 46
60. marmorata Coop 47
40. Trygon Adanson. (Addenda) 47, 65, 879
61. centrura Mitch 47, 67, 879
61 (*b*). hastata Dek. (Addenda) 70, 879
62. sayi Le S 48, 69, 879
63. dipterura J. & G 48, 71, 879
64. tuberculata Lac 48, 66, 879
65. sabina Le S 49, 68, 879
Family 22. Myliobatidæ 49
41. Stoasodon Cantor. (Addenda) 50, 879
66. narinari Euphr 50, 879
42. Myliobatis Dum 50
67. freminvillei Le S 51
68. californicus Gill 51
43. Rhinoptera Kuhl 51
69. quadriloba Le S 51
Family 23. Cephalopteridæ 52
44. Manta Bancroft 52
70. birostris Walb 52
Subclass Holocephali 53
Order F. Holocephali 53
Family 24. Chimæridæ 53
45. Chimæra L 54
§ *Chimæra* 54
71. plumbea Gill 54
§ *Hydrolagus* Gill 54
72. colliei Benn 55
Class IV. Pisces 73
Subclass Chondrostei 82
Order G. Selachostomi 82
Family 25. Polyodontidæ 82
46. Polyodon Lac 83
73. spathula Walb 83
Order H. Glaniostomi 84
Family 26. Acipenseridæ 84
47. Acipenser L 85
74. sturio L 85
75. transmontanus Rich 86
76. medirostris Ayres 86
77. rubicundus Le S 87
78. brevirostris Le S 87
48. Scaphirhynchops Gill 88
79. platyrhynchus Raf 88

Class IV. Pisces—continued. Page.
Subclass Holostei ... 88
Order I. Ginglymodi ... 89
Family 27. Lepidosteidæ ... 89
49 (50). Lepidosteus Lac ... 90
§ *Lepidosteus* ... 91
80. osseus L ... 91
§ *Cylindrosteus* Raf ... 91
81. platystomus Raf ... 91
§ *Atractosteus* Raf. (Addenda) ... 92, 880
82. tristœchus Bloch & Schneider ... 92
Order J. Halecomorphi ... 92
Family 28. Amiidæ ... 92
51. Amia L ... 94
83. calva L ... 94
Subclass Physostomi ... 94
Order K. Nematognathi ... 95
Family 29. Siluridæ ... 96
52. Noturus Raf ... 97
§ *Schilbeodes* Bleek ... 98
84. gyrinus Mitch ... 98
85. leptacanthus Jor ... 98
86. miurus Jor ... 99
87. eleutherus Jor ... 99
88. exilis Nels ... 100
89. insignis Rich ... 100
§ *Noturus* ... 100
90. flavus Raf ... 100
53. Leptops Raf. (Addenda) ... 101, 881
91. olivaris Raf ... 102, 881
54. Gronias Cope ... 102
92. nigrilabris Cope ... 102
55. Amiurus Raf ... 102
93. brunneus Jor ... 103
94. platycephalus Grd ... 103
95. xanthocephalus Raf ... 104
96. melas Raf ... 104
97. marmoratus Holbr ... 104
98. catus L ... 104
98 (*b*). brachyacanthus Cope. (Addenda) ... 881
99. vulgaris Thomps ... 105
100. natalis Le S ... 105
100 (*b*). bolli Cope. (Addenda) ... 881
101. erebennus Jor ... 105
56. Ictalurus Raf ... 106, 880
102. lophius Cope ... 107
103. albidus Le S ... 107
104. lupus Grd ... 107
105. niveiventris Cope ... 107
106. nigricans Le S. (Addenda) ... 108, 882
107. ponderosus Bean ... 108
108. punctatus Raf ... 108
109. furcatus C. & V ... 109
57. Arius C. & V ... 109
110 (111). felis L ... 110, 882
58. Ælurichthys B. & G ... 110
112. marinus Mitch ... 111

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order L. Eventognathi. (Addenda) 111, 882
Family 30. Catostomidæ 112
59 (60, 61). Ictiobus Raf 113, 882
§ *Sclerognathus* C. & V. (Addenda) 883
113. cyprinella C. & V. (Addenda) 114, 883
§ *Ictiobus*. (Addenda) 115, 883
114. urus Ag 116, 883
115. bubalus Raf. (Addenda) 116, 883
§ *Carpiodes* Raf 117, 883
116. carpio Raf 118, 883
117. damalis Grd. (Addenda) 118, 883
118. thompsoni Ag 119, 883
119. bison Ag 119, 883
120. cyprinus Le S 119, 883
121. difformis Cope 120, 883
62. Cycleptus Raf 120
122. elongatus Le S 121
63. Pantosteus Cope 121
123. plebeius B. & G 122
124. delphinus Cope 122
125. bardus Cope 122
126. platyrhynchus Cope 123
127. generosus Grd 123
128. virescens Cope 124
64. Catostomus Le S 124
§ *Catostomus* 125
129. discobolus Cope 125
130. latipinnis B. & G 125
130 (*b*). guzmaniensis Grd 126
130 (*c*). nebulifer Garm. (Addenda) 883
131. retropinnis Jor 126
132. longirostris Le S 126
133. tahoensis Gill & Jor 127
§ *Decactylus* Raf 127
134. ræopus Jor 127
135. labiatus Ayr 127
136. macrochilus Grd 128
137. occidentalis Ayr 128
138. bernardini Grd 128
139. ardens J. & G 128
140. fecundus Cope & Yarrow 129
141. cypho Lock 129
142. commersoni Lac 129
143. insignis B. & G 130
144. clarki B. & G 130
§ *Hypentelium* Raf 130
145. nigricans Le S 130
65. Chasmistes Jor 131
§ *Chasmistes* 132
146. liorus Jor 132
§ *Lipomyzon* Cope 132
147. brevirostris Cope 132
148. luxatus Cope 132

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order L. Eventognathi.
Family 30. Catostomidæ.
66. Erimyzon Jor 132
149. sucetta Lac 133
150. goodei Jor 134
67. Minytrema Jor 135
151. melanops Raf 136
68. Moxostoma Raf 136
152. papillosum Cope 137
153. velatum Cope 138
154. bucco Cope 138
155. pidiense Cope 138
156. coregonus Cope 139
157. album Cope 139
158. thalassinum Cope 139
159. carpio C. & V 139
160. macrolepidotum Le S 140
161. aureolum Le S 140
162. crassilabre Cope 140
163. conus Cope 141
164. anisurum Raf 141
165. pœcilurum Jor 141
166. albidum Grd 141
167. cervinum Cope 142
69. Placopharynx Cope 142
168. carinatus Cope 143
70. Quassilabia Jor. & Brayt. 143
169. lacera J. & B 144
Family 31. Cyprinidæ 144
71. Campostoma Ag 148
170. ornatum Grd 149
171. anomalum Raf 149
172. prolixum Stor 150
173. formosulum Grd 150
72. Acrochilus Ag 150
174. alutaceus Agassiz & Pickering 150
73. Orthodon Grd 151
175. microlepidotus Ayr 152
74. Lavinia Grd 152
176. exilicauda B. & G 153
75. Chrosomus Raf 153
177. erythrogaster Raf 153
178. oreas Cope 154
179. eos Cope 154
76. Zophendum Jor 154
180. siderium Cope 155
181. plumbeum Grd 155
77. Hybognathus Ag 155
182. nuchalis Ag 156, 968
182 (*b*). argyritis Grd. (Addenda) 968
183. amarus Grd 156
184. flavipinnis Cope 156
185. nigrotæniatus Cope 156

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order L. Eventognathi.
Family 31. Cyprinidæ.
186. placitus Grd 157
187. episcopus Grd 157
188. fluviatilis Grd 157
188 (*b*). punctifer Garm. (Addenda) 884
189. melanops Grd 157
78. Coliscus Cope 158
190. parietalis Cope 158
79. Pimephales Raf 158
191. promelas Raf 158
80. Hyborhynchus Ag 159
192. confertus Grd 159
193. notatus Raf 159
194. superciliosus Cope 160
80 (*b*). Tirodon Hay. (Addenda) 968
194 (*b*). amnigenus Hay. (Addenda) 968
81. Exoglossum Raf 160
195. maxillingua Le S 160
82. Cochlognathus B. & G 161
196. ornatus B. & G 161
197. biguttatus Cope 161
83. Hemitremia Cope 162
§ *Hemitremia* 162
198. vittata Cope 162
§ *Chriope* Jor 162
199. bifrenata Cope 162
200. maculata Hay 162
201. heterodon Cope 163
84. Cliola Grd 163
§ *Miniellus* Jor .....
202. tuditana Cope 165
203. taurocephala Hay 166
204. hæmatura Cope 166
205. spectruncula Cope 166
206. nubila Forbes 167
207. fretensis Cope 167
208. longirostris Hay 167
209. straminea Cope 167
210. volucella Cope 168
211. microstoma Raf 168
212. lineolata Ag 168
213. missuriensis Cope 168
214. procne Cope 169
§ *Cliola* 169
215. vigilax B. & G 169
216. chlora Jor 169
§ *Tiaroga* Grd 170
217. cobitis Grd 170
218. sima Cope 170
§ *Hudsonius* Grd 170
219. saludana Jor. & Brayt 170
220. storeriana Kirt 171

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order L. Eventognathi.
Family 31. Cyprinidæ.
221. hudsonia Clint 171
222. euryopa Bean 171
§ *Codoma* Grd 172
223. iris Cope 172
224. jugalis Cope 172
225. vittata Grd 172
226. ornata Grd 173
227. callisema Jor 173
§ *Moniana* Grd 173
228. gibbosa Grd 174
229. forbesi Jor 174
230. leonina Grd 174
231. lutrensis B. & G 175
232. deliciosa Grd 175
233. aurata Grd 175
234. formosa Grd 175
§ *Cyprinella* Grd 176
235. umbrosa Grd 176
236. bubalina B. & G 176
236 (*b*). rubripinna Garm. (Addenda) 884
237. gunnisoni Grd 176
238. suavis Grd 176
239. lepida Grd 177
240. billingsiana Cope 177
241. macrostoma Grd 177
242. ludibunda Grd 177
243. notata Grd 177
244. venusta Grd 178
245. calliura Jor 178
246. whipplei Grd 178
§ *Photogenis* Cope 179
247. analostana Grd 179
§ *Erogala* Jor 179
248. galactura Cope 179
249. eurystoma Jor 180
250. nivea Cope 180
251. callistia Jor 181
252. trichroistia J. & G 181
253. stigmatura Jor 182
254. cœrulea Jor 182
255. chloristia J. & B 183
256. zonata Ag 183
257. xænura Jor 184
258. pyrrhomelas Cope 184
259. hypseloptera Gthr 184
85. Minnilus Raf 185
§ *Luxilus* Raf 186
260. cornutus Mitch 186
261. selene Jor 188
262. coccogenis Cope 188
263. zonistius Jor 188

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order L. Eventognathi.
Family 31. Cyprinidæ.
§ *Alburnops* Grd 189
264. roseus Jor 189
265. rubricroceus Cope 189
266. lutipinnis Jor. & Brayt 190
267. chlorocephalus Cope 190
268. chiliticus Cope 191
269. chalybæus Cope 191
270. chrosomus Jor 191
271. xænocephalus Jor 192
272. plumbeolus Cope 192
273. lacertosus Cope 192
274. shumardi Grd 192
275. blennius Grd 193
276. cercostigma Cope 193
§ —— 193
277. ariommus Cope 194
278. scabriceps Cope 194
279. jejunus Forb 194
280. leuciodus Cope 194
281. altipinnis Cope 195
282. amabilis Grd 195
283. megalops Grd 195
284. bivittatus Cope 195
285. timpanogensis Cope 196
§ *Lythrurus* Jor 196
286. cyanocephalus Copeland 196
287. atripes Jor 197
288. diplæmius Raf 197
289. ardens Cope 198
290. punctulatus Hay 198
291. rubripinnis Hay 198
292. bellus Hay 199
293. matutinus Cope 199
294. lirus Jor 199
§ *Minnilus* 200
296. oligaspis Cope 200
297. umbratilis Grd 200
298. scepticus J. & G 200
299. photogenis Cope 201
300. telescopus Cope 201
301. stilbius Jor 201
302. percobromus Cope 202
303. rubellus Ag 202
304. dinemus Raf 202
305. rubrifrons Cope 202
306. jemezanus Cope 203
307. micropteryx Cope 203
86. Protoporus Cope 203
308. domninus Cope 204
87. Ericymba Cope 204
309. buccata Cope 204

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order L. Eventognathi.
Family 31. Cyprinidæ.
88. Phenacobius Cope 205
310. teretulus Cope 205
311. mirabilis Grd 205
311 (*b*). scopifer Cope 205
312. catostomus Jor 206
313. uranops Cope 206
89. Rhinichthys Ag 206, 884
314. cataractæ C. & V 207, 885
315. maxillosus Cope 207, 885
316. transmontanus Cope 207, 885
316 (*b*). dulcis Grd. (Addenda) 885
317. obtusus Ag 208, 885
318. atronasus Mitch 208, 885
318 (*b*). badius Garm. (Addenda) 886
318 (*c*). simus Garm. (Addenda) 886
318 (*d*). meleagris Ag. (Addenda) 886
318 (*e*). arenatus Garm. (Addenda) 886
90. Agosia Grd 208
319. chrysogaster Grd 209
320. metallica Grd 209
91. Apocope Cope 209
321. carringtoni Cope 209
322. nubila Grd 210
323. vulnerata Cope 210
324. henshavii Cope 210
325. oscula Grd 211
326. ventricosa Cope 211
92. Ceratichthys Baird 211
327. biguttatus Kirt 212
328. micropogon Cope 212
329. symmetricus B. & G 213
330. cumingi Gthr 213
331. lucens Jor 213
332. amblops Raf 214
333. rubrifrons Jor 214
334. hypsinotus Cope 215
335. dissimilis Kirt 215
336. sterletus Cope 216
337. æstivalis Grd 216
338. gelidus Grd 216
339. labrosus Cope 217
340. zanemus Jor. & Brayt 217
341. monachus Cope 217
93. Couesius Jor 218
342. squamilentus Cope 218
343. dissimilis Grd 218
344. prosthemius Cope 219
345. physignathus Cope 219
94. Platygobio Gill 219
346. gracilis Rich 219
347. pallidus Forbes 220

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order L. Eventognathi.
Family 31. Cyprinidæ.
95. Semotilus Raf 220
§ *Semotilus* 221
347 (*b*). corporalis Mitch 221
348. thoreauianus Jor 221
§ *Leucosomus* Heck 222
349. bullaris Raf 222
96. Symmetrurus Jor 222
350. argyriosus Grd 222
97. Pogonichthys Grd 223
351. macrolepidotus Ayres 223
97 (*b*). Stypodon Garm 223
352. signifer Garm 224
98. Mylochilus Ag 224
353. caurinus Rich 224
99. Mylopharodon Ayres 225
354. conocephalus B. & G 225
100. Ptychochilus Ag 225
355. oregonensis Rich 226
356. rapax Grd 226
357. harfordi J. & G 226
358. lucius Grd 227
101. Gila B. & G 227
359. elegans B. & G 227
360. robusta B & G 228
361. grahami B. & G 228
362. affinis Abbott 229
363. gracilis B. & G 229
364. emorii B. & G 229
365. nacrea B. & G 230
366. seminuda Cope & Yarrow 230
102. Squalius Bon 230
§ *Clinostomus* Grd 231
367. elongatus Kirt 232
368. vandoisulus C. & V 232
369. estor Jor. & Brayt 232
370. funduloides Grd 233
§ *Tigoma* Grd 233
371. hydrophlox Cope 233
372. tænia Cope 234
373. montanus Cope 234
374. humboldti Grd 234
375. cruoreus J. & G 234
376. ardesiacus Cope 235
377. pandora Cope 235
378. margaritus Cope 235
379. gula Cope 236
380. pulcher Grd 236
381. egregius Grd 236
382. lineatus Grd 236
383. gracilis Grd 237
384. conformis B. & G 237

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order L. Eventognathi.
Family 31. Cyprinidæ.
385. bicolor Grd 237
386. obesus Grd 237
387. purpureus Grd 238
388. pulchellus B. & G 238
389. intermedius Grd 238
390. aliciæ Jouy 238
391. copei J. & G 238
392. niger Cope 239
393. conspersus Garm 239
§ *Siboma* Girard 239
394. gibbosus Ayres 239
§ *Squalius* 240
395. rhomaleus J. & G 240, 886
396. squamatus Gill 241
397. atrarius Grd 241, 886
398. crassus Grd 241
§ *Cheonda* Grd 241
399. cœruleus Grd 241
400. cooperi Grd 242
401. nigrescens Grd 242
402. modestus Garm 242
103. Phoxinus Agassiz 242
403. neogæus Cope 243
404. flammeus J. & G 243
405. milnerianus Cope 243
406. phlegethontis Cope 244
104. Myloleucus Cope. (Addenda) 244, 887
407. tincella C. & V 245
408. obesus Grd 245
409. formosus Grd 245
410. bicolor Grd 246
411. anticus Cope 246
412. boucardi Gthr 246
105. Opsopœodus Hay 246
413. emiliæ Hay 247
106. Trycherodon Forbes 247
414. megalops Forbes 247
107. Notemigonus Raf 248
415. gardoneus C. & V 249
416. lucidus Grd 249
417. leptosomus Grd 249
418. occidentalis B. & G 250
419. chrysoleucus Mitch 250
420. americanus L 250
108. Richardsonius Girard 251
421. balteatus Rich 251
422. lateralis Grd 251
109. Lepidomeda Cope 251
423. vittata Cope 252
424. jarrovii Cope 252
110. Meda Girard 252
425. fulgida Grd 252

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order L. Eventognathi.
Family 31. Cyprinidæ.
111. Plagopterus Cope 253
426. argentissimus Cope 253
112. Carassius Nilsson 253
427. auratus Linn 253
113. Cyprinus Linn 254
428. carpio L 254
Family 32. Characinidæ 254
114. Tetragonopterus Cuv 255
§ *Astyanax* B. & G 255
429. argentatus B. & G 255
Order M. Isospondyli 256
Family 33. Alepocephalidæ 257
115. Alepocephalus Risso 257
430. bairdii G. & B 257
Family 34. Albulidæ 258
116. Albula Gronov 258
431. vulpes L 258
Family 35. Hyodontidæ 259
117. Hyodon Le Sueur 259
432. alosoides Raf 259
433. tergisus Le Sueur 260
434. selenops Jor. & Bean 260
Family 36. Elopidæ 260
118. Elops L 261
435. saurus L 261
119. Megalops Lac 261
436. atlanticus C. & V. (Addenda) 262, 887
Family 37. Clupeidæ 262
120. Etrumeus Bleek 263
437. teres Dek 263
121. Spratelloides Bleeker 263
438. bryoporus Cope 264
122. Clupea L 264
§ *Clupea* 264
439. harengus L 265
440. mirabilis Grd 265
§ *Sardinia* Poey. (Addenda) 887
441. sagax Jen 265
441 (*b*). pseudohispanica Poey. (Addenda) 887
§ *Pomolobus* Raf 265
442. chrysochloris Raf 266
443. mediocris Mitch 266
444. vernalis Mitch 267
445. æstivalis Mitch 267
§ *Alosa* Cuv 267
446. sapidissima Wils 267
123. Harengula C. & V 268
447. pensacolæ G. & B 268
124. Opisthonema Gill 268
448. thrissa Osbeck 268

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order M. Isospondyli.
Family 37. Clupeidæ.
125. Brevoortia Gill 269
449. patronus Goode 269
450. tyrannus Latr 269
Family 38. Dorosomatidæ 270
126. Dorosoma Raf 271
451. cepedianum Le S 271
451 (*b*). mexicanum Gthr. (Addenda) 887
Family 39. Engraulididæ 271
127. Stolephorus Lac 272
452. ringens Jen 272
453. browni Gmel 273
454 (*b*). mitchilli C. & V. (Addenda) 888
455. perfasciatus Poey 273
456. delicatissimus Grd 274
457. compressus Grd 274
Family 40. Alepidosauridæ 274
128. Alepidosaurus Lowe 276
§ *Alepidosaurus* 276
458. ferox Lowe 276
458 (*b*). æsculapius Bean. (Addenda) 888
§ *Caulopus* Gill 276
459. borealis Gill 276
Family 41. Paralepididæ 276
129. Sudis Rafinesque 277
§ *Sudis* 277
460. ringens J. & G 277
§ *Paralepis* Risso 278
461. borealis Reinh 278
462. coruscans J. & G 278
Family 42. Scopelidæ 279
130. Synodus B. & S 279
§ *Synodus* 280
463. fœtens Linn 280
464. lucioceps Ayres 281
464 (*b*). intermedius Spix. (Addenda) 889
§ *Trachinocephalus* Gill 281
465. myops Forster 281
131. Myctophum Raf 281
466. crenulare J. & G 282
467. glaciale Reinh 283
Family 43. Sternoptychidæ 283
132. Maurolicus Cocco 283
468. borealis Nilss 284
Family 44. Chauliodontidæ 284
133. Chauliodus Bl. & Schn 284
469. sloani Bl. & Schn 285
Family 45. Stomiatidæ 285
134. Stomias Cuv 286
470. ferox Reinh 286
135. Echiostoma Lowe 286
471. barbatum Lowe 287

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order M. Isospondyli.
Family 45. Stomiatidæ.
136. Malacosteus Ayres 287
472. niger Ayres 287
137. Astronesthes Rich 287
473. niger Rich 288
Family 46. Salmonidæ 288
138. Microstoma Cuvier 289
474. grœnlandicum Reinh 290
140. Mallotus Cuvier 291
476. villosus Müll 291
141. Thaleichthys Girard 291
477. pacificus Rich 292
142. Osmerus Linnæus 292
478. thaleichthys Ayres 292
479. attenuatus Lock 293
480. mordax Mitch 293
481. dentex Steind 294
143. Hypomesus Gill 294
482. pretiosus Grd 294
483. olidus Pallas 295
144. Argentina L 295
§ *Silus* Reinh 295
484. syrtensium G. & B 295
145. Hyphalonedrus Goode 296
485. chalybeius Goode 296
146. Coregonus Linnæus 296
§ *Prosopium* Milner 297
486 (487). williamsoni Grd 297
488. quadrilateralis Rich 298
489. kennicotti Milner 298
§ *Coregonus* 299
490. clupeiformis Mitch 299
491. labradoricus Rich 299
492. hoyi Gill 299
§ *Argyrosomus* Ag 300
493. merki Gthr 300
493 (*b*). laurettæ Bean. (Addenda) 889
494. artedi Le S 301
495. nigripinnis Gill 301
§ *Allosomus* Jor 301
496. tullibee Rich 301
147. Thymallus Cuv 302
497. signifer Rich 302
148. Stenodus Rich 304
498. mackenzii Rich 304
149. Oncorhynchus Suckley 304
499. gorbuscha Walb 305
500. keta Walb 305
501. tchawytcha Walb. (Addenda) 306, 890
502. kisutsch Walb 307
503. nerka Walb 308
150. Salmo L 309

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order M. Isospondyli.
Family 46. Salmonidæ.
§ *Salmo* 311
504. salar L 311
§ *Fario* C. & V 312
505. irideus Gibbons 312
506. gairdneri Rich 313
507. spilurus Cope 314
508. purpuratus Pall 314
151. Salvelinus Rich 316
§ *Cristivomer* Gill & Jor 317
509. namaycush Walb 317
§ *Salvelinus* 318
510 (511). oquassa Grd 318
512. arcturus Gthr 319
513. malma Walb 319
514 (515). fontinalis Mitch 320
516. rossi Rich 321
517. nitidus Rich 321
518. stagnalis Fabr 321
Family 47. Percopsidæ 322
152. Percopsis Ag 322
519. guttatus Ag 322
Order N. Haplomi 323
Family 48. Amblyopsidæ 323
153. Amblyopsis De K 324
520. spelæus De K 324
154. Typhlichthys Girard 324
521. subterraneus Grd 325
155. Chologaster Agassiz 325
522. cornutus Ag 325
523. agassizi Putnam 325
523 (*b*). papillifer Forbes. (Addenda) 325, 890
Family 49. Cyprinodontidæ 326
156. Jordanella G. & B 327
524. floridæ G. & B 328
157. Cyprinodon Lac 328
525. variegatus Lac 329, 890
526. bovinus B. & G. (Addenda) 890
526 (*b*). eximius Grd. (Addenda) 890
527. latifasciatus Garm 329
528. elegans B. & G 329
529. californiensis Grd 330
530. macularius B. & G 330
531. carpio Gthr 330
158. Fundulus Lac 331
§ *Hydrargyra* Lac 332
532. majalis Walb 332
533. swampinus Lac. 332
534. similis B. & G 333
535. zebrinus J. & G. (Addenda) 333, 891
536. parvipinnis Grd 333

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order N. Haplomi.
Family 49. Cyprinodontidæ.
§ *Fundulus* 334
537. seminolis Grd 332
538. diaphanus Le S 334
539. confluentus G. & B 334
540. menona Jor. & Copel 335
541. adinia J. & G 335
542. nigrofasciatus Le S 335
542 (*b*). ocellaris J. & G. (Addenda) 891
543. heteroclitus L 336
543 (*b*). grandis B. & G. (Addenda) 891
§ *Xenisma* Jor 336
544. catenatus Storer 337
545. stellifer Jor 337
§ *Adinia* Grd. (Addenda) 892
545 (*b*). xenicus J. & G. (Addenda) 892
159. Zygonectes Ag 338
546. rubrifrons Jor 338
547. henshalli Jor 338
548. floripinnis Cope 339
549. lineatus Garm 339
550. notatus Raf 339
552. inurus J. & G. (Addenda) 340, 892
553. dispar Ag 341
553 (*b*). craticula G. & B. (Addenda) 892
554. brachypterus Cope 341
555. sciadicus Cope 342
556. chrysotus Gthr 342
557. zonatus Mitch 342
558. cingulatus C. & V 342
160. Lucania Girard 342
559. venusta Grd 343, 893
560. parva B. & G 343, 893
561. goodei Jor 343
161 Gambusia Poey 344
562 (563) (565). patruelis B. & G 345, 893
564. arlingtonia G. & B 345
566. nobilis B. & G 346
566 (*b*). senilis Grd. (Addenda) 894
162. Mollienesia Le Sueur 346
567. latipinna Le S 347, 894
567 (*b*). lineolata Grd. (Addenda) 894
163. Pœcilia Bl. & Schn 347
568. couchiana Grd 348
164. Girardinus Poey 348
569. formosus Grd 349
570. occidentalis B. & G 349
Family 50. Umbridæ 349
165. Umbra Müller 350
571. limi Kirt 350
166. Dallia Bean 350
572. pectoralis Bean 351

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order N. Haplomi.
Family 51. Esocidæ 351
167. Esox L 352
§ *Picorellus* Raf 352
573. americanus Gmel 352
574. umbrosus Kirt. (Addenda) 352, 894
575. reticulatus Le S 353
§ *Esox* 353
576. lucius Linn 353
§ *Mascalongus* Jor 353
577. nobilior Thompson 353
Order O. Apodes 354
Family 52. Muræenidae 355
168. Muræna Linn 355
§ *Muræna* 355
578. retifera Goode & Bean. (Addenda) 894
§ *Sidera* Kaup. (Addenda) 356, 969
579. mordax Ayres 356
580. ocellata Agassiz 356
580 (*b*). afra Bloch. (Addenda) 895
580 (*c*). moringa Cuv. (Addenda) 895
Family 53. Anguillidæ 357
168 (*b*). Letharchus Goode & Bean. (Addenda) 896
580 (*b*). velifer Goode & Bean. (Addenda) 896
169. Cœcula Vahl 358
§ *Callechelys* Kaup. (Addenda) .....
581. scuticaris G. & B 358
581 (*b*). teres Goode & Bean. (Addenda) 897
170. Murænopsis LeS. (Addenda) 358, 969
582. mordax Poey. (Addenda) 897
583. triserialis Kaup 359, 897
583 (*b*). macrurus Poey. (Addenda) 898
583 (*c*). chrysops Poey. (Addenda) 898
584. ocellatus Le S 359
170 (*b*). Ophichthys Ahl. (Addenda) 899, 969
584 (*b*). longus Poey. (Addenda) 899
171. Myrichthys Girard 360
585. tigrinus Grd 360
171 (*b*). Myrophis Lütken. (Addenda) 899
585 (*b*). lumbricus J. & G. (Addenda) 899
585 (*c*). microstigmius Poey. (Addenda) 900
172. Neoconger Girard 360
586. mucronatus Grd 360
173. Anguilla Thunberg 361
587. rostrata Le S 361
174. Leptocephalus Gmelin. (Addenda) 362, 969
588. conger L. (Addenda) 362, 969
588 (*b*). caudicula Bean. (Addenda) 900
175. Simenchelys Gill 363
589. parasiticus Gill 363
Family 54. Synaphobranchidae 364
176. Synaphobranchus Johnson 364
590. pinnatus Gron 364

Class IV. Pisces—continued. Page.
Subclass Physostomi.
Order O. Apodes.
Family 55. Saccopharyngidæ 365
177. Saccopharynx Mitch 365
591. flagellum Mitch 365
Family 56 (*a*). Nemichthyidæ 365
178. Nemichthys Rich 366
592. scolopaceus Rich 366
593. avocetta J. & G 367
Sub-class Physoclisti 367
Order P. Opisthomi 368
Family 56 (*b*). Mastacembelidæ 368
179. Ptilichthys Bean 369
594. goodei Bean 369
Family 56. (*c*). Notacanthidæ 370
180. Notacanthus Bloch 370
595. chemnitzi Bloch 370
595 (*b*). phasganorus Goode. (Addenda) 900
Order Q. Synentognathi 371
Family 57. Scomberesocidæ 371
181. Tylosurus Cocco 372
596. hians C. & V 373, 901
597. caribbæus Le S. (Addenda) 373, 901
598. notatus Poey 373
599. marinus Bl. & Schn. (Addenda) 374, 902
600. exilis Grd 374
600 (*b*). gladius Bean. (Addenda) 901
182. Scomberesox Lac 374
601. saurus Walb 375
602. brevirostris Peters 375
183. Hemirhamphus Cuvier 376
§ *Hemirhamphus* 376
603. unifasciatus Ranz 376
604. rosæ J. & G 376
604 (*b*). brasiliensis L. (Addenda) 902
§ *Euleptorhamphus* Gill 377, 903
605. longirostris Cuv 377
183 (*b*). Chriodorus Goode & Bean. (Addenda) 903
605 (*b*). atherinoides Goode & Bean. (Addenda) 903
184. Halocypselus Weinland 377
606. evolans Linn 377
607. obtusirostris Gthr 378
185. Exocœtus L 378
607. (*b*). hillianus Gosse. (Addenda) 903
608. californicus Cooper 379
609. rondeletii C. & V. (Addenda) 379, 904
610. noveboracensis Mitch. (Addenda) 904
611. exiliens Gmel 380, 904
186. Cypselurus Swainson 380
612. furcatus Mitch 380
613. comatus Mitch 381
Order R. Lophobranchii 381
Family 58. Syngnathidæ 382
187. Siphostoma Raf 382, 905

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order R. Lophobranchii.
Family 58. Syngnathidæ.
§ *Siphostoma* 383
614. fuscum Stor 383, 906
614 (*b*). affinis Gthr 383, 904
615. louisianæ Gthr 383, 906
615 (*b*). floridæ J. & G. (Addenda) 905
616. californiense Stor 384, 906
616 (*b*). griseolineatum Ayr. (Addenda) 905
616 (*c*). bairdianum Dum. (Addenda) 905
617. leptorhynchus Grd 384, 906
617 (*b*). auliscus Swain. (Addenda) 384, 905
§ *Dermatostethus* Gill 385
618. punctipinne Gill 385, 905
§ *Corythrichthys* Kaup. (Addenda) 906
618 (*b*). zatropis J. & G. (Addenda) 906
Family 59. Hippocampidæ 385
188. Hippocampus Raf 386
619. heptagonus Raf 386
619 (*b*). punctulatus Guich. (Addenda) 907
619 (*c*). hudsonius Dek. (Addenda) 907
619 (*d*). stylifer J. & G. (Addenda) 907
619 (*e*). zosteræ J. & G. (Addenda) 907
620. ingens Grd 386
Order S. Hemibranchii 387
Family 60. Centriscidæ 387
189. Centriscus L 388
621. scolopax L 388
Family 61. Fistulariidæ 388
190. Fistularia Linn 389
622. tabaccaria L 389
623. serrata Cuv 390
Family 62. Aulostomatidæ 390
191. Aulostoma Lacépède 390
624. maculatum Val 390
Family 63. Aulorhynchidæ 391
192. Aulorhynchus Gill 391
625. flavidus Gill 391
Family 64. Gasterosteidæ 392
193. Gasterosteus L 393
§ *Pygosteus* Brev 393
626. pungitius L 393
§ *Eucalia* Jor 394
627. inconstans Kirt 394
§ *Gasterosteus* 394
628. microcephalus Grd 395
629. biaculeatus Shaw 395
630. atkinsii Bean 395
631. aculeatus L 395
631 (*b*). cataphractus Pall 396
194. Apeltes Dek 396
632. quadracus Mitch 396

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri 397
Family 65. Mugilidæ 401
195. Mugil L 402
634 (633). albula L 403
635. brasiliensis Ag 403
Family 66. Atherinidæ 404
196. Atherina L 405
636. carolina C. & V 405
637. veliana G. & B 405
197. Leuresthes J. & G 405
638. tenuis Ayres 405
198. Labidesthes Cope 406
639. sicculus Cope 406
199. Menidia Bonap 406, 969
640. laciniata Swain. (Addenda) 407, 908
641. vagrans G. & B 407
642. notata Mitch 407
742 (*b*). audens Hay. (Addenda) 908
643. beryllina Cope 408
644. bosci C. & V. (Addenda) 408, 909
645. peninsulæ G. & B 408
200. Atherinopsis Grd 409
646. californiensis Grd 409
201. Atherinops Steind 409
647. affinis Ayres 409
Family 67. Sphyrænidæ 410
202. Sphyræna Bloch 410
648. argentea Grd 411
649. spet Haüy 411
650. guaguancho C. & V 411
650 (*b*). picuda Bl. & Schn 412
Family 68. Polynemidæ 412
203. Polynemus Linn 413
650 (*c*). plumieri Lac 413
650 (*d*). octofilis Gill 413
651. octonemus Grd 413
Family 69. Ammodytidæ 414
204 (205). Ammodytes L 414, 909
652 (653, 656?). americanus DeK 414, 415, 909
654. alascanus Cope 415
655. dubius Reinh 415
Family 70. Echeneididæ 416
206. Echeneis L 416
657. naucrates L 416
206 (*b*). Phthirichthys Gill 969
657 (*b*). lineatus Menzies. (Addenda) 969
206 (*c*). Remora Gill. (Addenda) 417, 909
658. squalipeta Dald. (Addenda) 417, 909
659. brachyptera Lowe 417
207. Rhombochirus Gill 417
660. osteochir Cuv 418
Family 71. Elacatidæ 418
208. Elacate Cuv 418
661. canada L 418

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 72. Xiphiidæ 419
209. Xiphias L 419
662. gladius L 420
210. Tetrapturus Raf 420
663. indicus C. & V. (Addenda) 420, 909
664. [amplus Poey] 420
211. Histiophorus Lacepede 421
665. gladius Brouss 421
Family 73. Trichiuridæ 421
212. Trichiurus L 422
666. lepturus L 422
212 (*b*). Benthodesmus G. & B. (Addenda) 910
666 (*b*). elongatus Clarke. (Addenda) 910
Family 74. Scombridæ 422
213. Scomber L 423
667. pneumatophorus Delaroche 424, 910
667 (*b*). colias Gmel. (Addenda) 910
668. scombrus L 424
214. Auxis Cuvier 424
669. thazard Lac. (Addenda) 425, 911
215. Scomberomorus Lac 425
670. concolor Lock 425
671. maculatus Mitch 426
672. regalis Bloch 426
673. caballa C. & V 427
216. Sarda Cuvier 427
674. mediterranea Bl. & Schn 427
675. chilensis C. & V 428
217. Orcynus Cuv 428
676. alalonga Gmel 428
677. thynnus L 429
218. Euthynnus Lütken 429
678. alliteratus Raf 430
679. pelamys L 430
Family 75. Carangidæ 430
219. Trachurus Raf 431
680. picturatus Bowd. (Addenda) 432, 911
681. saurus Raf 432, 911
220. Decapterus Bleek 432
682. punctatus Ag 432
683. macarellus C. & V 433
221. Caranx Lac 433, 970
684. crumenophthalmus Bloch 434
685. chrysus Mitch. (Addenda) 435
686. caballus Gthr 435
687. cibi Poey 436
688. beani Jor 436
689. amblyrhynchus C. & V. (Addenda) 436, 912
690. fallax C. & V 437
691. hippos L 437
222. Blepharis Cuv 438
692. crinitus Akerly 438

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 75. Carangidæ.
223. Selene Lac 439
§ *Selene* 439
693. vomer L 439
§ *Vomer* Cuv 440
694. setipinnis Mitch 440
224. Chloroscombrus Grd 440
695. chrysurus L 441
225. Trachynotus Lac 441
696. carolinus L 442
697. ovatus L 442
698. goreensis C. & V 442
699. glaucus Bloch 443, 970
226. Naucrates Raf 443
700. ductor L 443
227. Seriola Cuv 444
701. dorsalis Gill. (Addenda) 444, 912
701 (*b*). lalandi C. & V. (Addenda) 912
702. rivoliana C. & V 444
702 (*b*). falcata C. & V. (Addenda) 913
703. carolinensis Holb. (Addenda) 445, 913
704. zonata Mitch 445
705. fasciata Bloch 445
228. Elagatis Benn 446
706. pinnulatus Poey 446
229. Oligoplites Gill. (Addenda) 446, 913
707. occidentalis L 447
Family 76. Pomatomidæ 447
230. Pomatomus Lac 448
708. saltatrix L 448
Family 76 (*b*). Nomeidæ 448
231. Nomeus Cuv 449
709. gronovii Gmel 449
Family 77. Stromateidæ 449
232. Stromateus L 450
§ *Rhombus* Lac 451
710. paru L. (Addenda) 451, 914
§ *Stromateus* 451
711. simillimus Ayres 451
§ *Poronotus* Gill 451
712. triacanthus Peck 451
233. Lirus Lowe 452
713. perciformis Mitch 452
Family 78. Lamprididæ 453
234. Lampris Retz 453
714. guttatus Brün 453
Family 79. Coryphænidæ 454
235. Coryphæna L 454
715. equisetis L. (Addenda) 454, 914
716. hippurus L. (Addenda) 455, 914
Family 80. Bramidæ 455
236. Pteraclis Gronow 455
717. carolinus C. & V 455

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 80. Bramidæ.
236 (*b*). Brama Bloch & Schn. (Addenda) 915
717 (*b*). raji Bloch. (Addenda) 915
Family 81. Zenidæ 456
237. Zenopsis Gill 456
718. ocellatus Storer 457
Family 82. Berycidæ 457
238. Hoplostethus C. & V. 458
719. mediterraneus C. & V. 458
239. Holocentrum Bloch 459
720. pentacanthum Bloch 459
Family 83. Aphredoderidæ 460
240. Aphredoderus LeS 460
721. sayanus Gilliams 460
Family 83 (*b*). Elassomatidæ 461
241. Elassoma Jordan 461
722. zonatum Jor 461, 915
Family 84. Centrarchidæ 462
242. Centrarchus C. & V 463
723. macropterus Lac 463
243. Pomoxys Raf 464
724. annularis Raf 464
725. sparoides Lac 465
244. Archoplites Gill 465
726. interruptus Grd 466
245. Ambloplites Raf 466
727. rupestris Raf 466
246. Chænobryttus Gill 467
728. antistius McKay 467
729. gulosus C. & V 468
247. Acantharchus Gill 468
730. pomotis Baird 469
248. Enneacanthus Gill 469
731. eriarchus Jor 469
732. obesus Baird 470
733. gloriosus Holbr 470
734. simulans Cope 470
249. Mesogonistius Gill 471
735. chætodon Baird 471
250. Lepomis Raf 472
§ *Apomotis* Raf 473
736. cyanellus Raf 473
737. symmetricus Forbes 473
738. phenax Cope & Jor 474
§ *Lepomis* 474
739. ischyrus Jor. & Nelson 474
740. macrochirus Raf 475
741. mystacalis Cope 475
742. elongatus Holbrook 475
743. murinus Grd 475
744. punctatus C. & V 476

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 84. Centrarchidæ.
745. miniatus Jor 476
746. auritus Linn 477
747. megalotis Raf 477
748. marginatus Holbr 478
749. bombifrons Ag 478
§ *Helioperca* Jordan 479
750. humilis Grd 479
751. pallidus Mitch 479
§ *Xystroplites* Jor 480
752. heros B. & G 480
753. euryorus McKay 481
754. albulus Grd 481
§ *Eupomotis* Gill & Jor 482
755. holbrooki C. & V 482
756. notatus Ag 482
757. gibbosus L 482
758. lirus McKay 483
251. Micropterus Lac 484
759. salmoides Lac 484
760. dolomiei Lac 485
Family 85. Percidæ 486
252. Ammocrypta Jor 488
761. beani Jor 489
762. pellucida Baird 489
762 (*b*). vivax Hay. (Addenda) 970
763. asprella Jor 490
253. Ioa Jor. & Bray 490
764. vitrea Cope 490
764 (*b*). vigilis Hay. (Addenda) 971
254. Boleosoma DeKay 491
765. olmstedi Storer 492
766. nigrum Raf 492
767. effulgens Grd 493
768. vexillare Jor 493
769. æsopus Cope 493
255. Vaillantia Jor 493
770 (771). camura Forbes 494
256. Ulocentra Jor 494
772. phlox Cope 495
773. stigmæa Jor 495
774. atripinnis Jor 495
775. simotera Cope 496
257. Diplesium Raf 496
776. blennioides Raf 497
258. Cottogaster Putnam 497
777. copelandi Jor 498
778. putnami J. & G 498
259. Imostoma Jordan 498
779. shumardi Grd 498
260. Percina Haldeman 499
780. caprodes Raf 499
780 (*b*). manitou Jor 500

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 85. Percidæ.
261. Alvordius Girard 500
781. macrocephalus Cope 501
782. phoxocephalus Nelson 501
783. aspro Cope & Jor 501
784. nevisensis Cope 502
785. crassus Jor. & Brayt 503
786. variatus Kirt 503
787. evides Jor. & Copel 503
788. fasciatus Grd 504
262. Hadropterus Ag 505
789. aurantiacus Cope 506
790. nigrofasciatus Ag 506
263. Nothonotus Agassiz 506
791. camurus Cope 506
792. sanguifluus Cope 507
793. maculatus Kirtl 508
794. rufilineatus Cope 508
795. vulneratus Cope 508
796. tessellatus Storer 509
797. cinereus Storer 509
264. Nanostoma Putnam 509
798. zonale Cope 510
799. elegans Hay 510
800. thalassinum Jor. & Brayt 511
801. tessellatum Jor 511
802. inscriptum Jor. & Brayt 512
265. Etheostoma Raf 512
803. lineolatum Ag 513
804. flabellare Raf 513
805. squamiceps Jor 514
266. Pœcilichthys Ag 514
§ *Pœcilichthys* 515
806. virgatus Jor 515
807. saxatilis Hay 515
808. punctulatus Ag 516
809. artesiæ Hay 516
810. lepidus B. & G 517
811. cœruleus Storer 517
812. spectabilis Agassiz 518
813. asprigenis Forbes 518
814. jessiæ Jor. & Brayt 518
§ *Boleichthys* Grd 519
815. butlerianus Hay 519
816. barrattii Holbr 519
817. fusiformis Grd 520
818. erochrous Cope 520
819. eos Jor. & Copel 520
820. exilis Grd 521
821. warreni Grd 521
822. gracilis Grd 521
§ *Alvarius* Grd 522
823. lateralis Grd 522

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 85. Percidæ.
267. Microperca Putnam 522
824. prœliaris Hay 522
825. punctulata Putnam 523
268. Perca Linn 523
826. americana Schranck 524
269. Stizostedium Raf 525
827. vitreum Mitch 525
828. canadense Smith 526
Family 86. Serranidæ 526
270. Centropomus Lac 527
829. undecimalis Bloch 527
271. Roccus Mitch 527
§ *Roccus* 529
830. lineatus Bloch 529
831. chrysops Raf 529
§ *Morone* Gill 530
832. interruptus Gill 530
833. americanus Gmel 530
272. Stereolepis Ayres 531
834. gigas Ayres 531
273. Polyprion Cuvier 532
835. oxygenius Bl. & Schn 532
273 (*b*). Creolus J. & G. (Addenda) 916, 972
835 (*b*). furcifer C. & V. (Addenda) 916
274. Serranus Cuv 532
§ *Centropristis* Cuv 533
836. atrarius L 533
836 (*b*). nigrescens Bl. & Schn. (Addenda) 916
837. trifurcus L 534
§ *Diplectrum* Holbr 534
838. formosus L. (Addenda) 534, 971
§ *Prionodes* Jen. (Addenda) 535, 917
839. subligarius Cope 535, 917
§ *Paralabrax* Grd 535
840. clathratus Grd 535
841. maculofasciatus Steind 536
842. nebulifer Grd 536
274 (*b*). Hypoplectrus Gill. (Addenda) 937, 917
843. nigricans Poey. (Addenda) 537, 917
275. Trisotropis Gill 537
844. stomias Goode & Bean. (Addenda) 538, 918, 971
845. falcatus Poey 538
846. microlepis G. & B 538
846 (*b*). petrosus Poey. (Addenda) 918
276. Epinephelus Bloch 539
847. atlanticus Lac. (Addenda) 539, 918
848. drummond-hayi G. & B 540
849. morio Cuv 540
850 (853?). nigritus Holbr 540
850 (*b*). striatus Bloch. (Addenda) 918
850 (*c*). guttatus Gmel. (Addenda) 919

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 86. Serranidæ.
851. niveatus C. & V 541
853. ? guasa Poey (nigritus?) 542, 920
276 (*b*). Bodianus Bloch 541, 919
852. punctatus L 541
852 (*b*). tæniops C. & V. (Addenda) 919
278. [Dules Cuvier] 542
854. [auriga C. & V.] 542
279. Rhypticus Cuvier 543
§ *Promicropterus* Gill 543
855. maculatus Holb 543
856. [nigripinnis Gill.] (Addenda) 543, 920
857. pituitosus G. & B 543
Family 87. Priacanthidæ 544
280. Priacanthus Cuv 544
§ *Priacanthus* 544
858. arenatus C. & V. (Addenda) 544, 971
§ *Pseudopriacanthus* Bleek 545
859. altus Gill 545
Family 88. Sparidæ 545
281. Xenistius J. & G. (Addenda) 546, 920
860. californiensis Steind 547, 920
282. Lutjanus Bl. & Schn 547
§ *Ocyurus* Gill 548
861. chrysurus Bloch. (Addenda) 548, 921
§ *Lutjanus* 548
862. caxis Bl. & Schn 548
862 (*b*). caballerote Bl. & Schn. (Addenda) 921
862 (*c*). campechianus Poey. (Addenda) 549, 921
863. blackfordi G. & B 549
864. stearnsi G. & B 549, 922
864 (*b*). synagris L. (Addenda) 922
§ *Rhomboplites* Gill 549
865. aurorubens C. & V 549
282 (*b*). Conodon C. & V. (Addenda) 550, 923
866. nobilis L 550, 923
283. Pomadasys Lac 550
§ *Orthopristis* Grd 551
867 (868). fulvomaculatus Mitch 551, 923
§ *Anisotremus* Gill. (Addenda) 923
869. davidsoni Steind 551
870. virginicus L 552
871. bilineatus C. & V 552
871 (*b*). interruptus Gill. (Addenda) 923
284. Diabasis Desm 553
872. plumieri Lac. (Addenda) 553, 971
872 (*b*). elegans C. & V. (Addenda) 923
873. chrysopterus L 553, 924
873 (*b*). chromis Brouss. (Addenda) 924
873 (*c*). albus C. & V. (Addenda) 924
874. fremebundus G. & B 554
874 (*b*). jeniguano Poey. (Addenda) 925
875. trivittatus Bl. & Schn 554

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 88. Sparidæ.
285. Lobotes Cuv 554
876. surinamensis Bloch 555
285 (*b*). Calamus Sw. (Addenda) 925
876 (*b*). megacephalus Sw. (Addenda) 926
876 (*c*). bajonado Bl. & Schn. (Addenda) 926
876 (*d*). macrops Poey. (Addenda) 927
876 (*e*). arctifrons Goode & Bean. (Addenda) 927
876 (*f*). medius Poey. (Addenda) 928
877 milneri G. & B. (Addenda) 556, 928
286. Sparus L 556
§ *Pagrus* Cuv 556
878. pagrus L 556, 928
286 (*b*). Stenotomus Gill. (Addenda) 557, 929
880. chrysops L. 556, 929
881. versicolor Mitch. (Addenda) 557, 929
881 (*b*). caprinus Bean. (Addenda) 929
286 (*c*). Lagodon Holbr. (Addenda) 558, 929
882. rhomboides L 558
287. Diplodus Raf 557, 929
§ *Archosargus* Gill 558, 929
883. probatocephalus Walb 558
§ *Diplodus* 559
884 (885). holbrooki Bean 559
885 (*b*). caribbæus Poey. (Addenda) 930
288. Girella Gray 560
886. nigricans Ayres 560
289. Cyphosus Lacèpéde (Addenda) 560, 972
887. bosqui Lac 561
290. Scorpis Cuv. & Val 562
§ *Cæsiosoma* Kaup 562
888. californiensis Steind 562
Family 89. Apogonidæ 563
219. Apogon Lac 563
§ *Apogon* 563
[889. americanus Castelnau] 563
889 (*b*). maculatus Poey. (Addenda) 930
§ *Apogonichthys* Bleek. (Addenda) 931
889 (*c*). alutus J. & G 931
§ *Glossamia* Gill 564
890. pandionis G. & B 564
Family 90. Mullidæ 564
292. Mullus L 564
891. barbatus L 565, 931
293. Upeneus Cuvier 565
§ *Pseudupeneus* Bleek 565
892. maculatus Bloch 565
Family 91. Sciænidæ 566
294. Haploidonotus Raf 567
893. grunniens Raf 567
295. Pogonias Lac 568
894. chromis Linn 568

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 91. Sciænidæ.
296. Sciæna L. 569
§ *Stelliferus* Stark 569
895. lanceolata Holbr. (Addenda) 569, 931
§ *Bairdiella* Gill 570
896. Chrysura Lac. (Addenda) 570, 931, 933
§ *Ophioscion* Gill .....
897. jacobi Steind 571
§ *Sciæna* 571, 931
898. ocellata L 571
296. (*b.*) Roncador J. & G. (Addenda) 572, 931
899. stearnsi Steind 572
296 (*c.*) Corvina Cuv. (Addenda) 932
§ *Corvina* 572
900. saturna Grd 572
§ *Pareques* Gill 573
901. acuminata Bl. & Schn 573
296. (*d*). Eques Bloch. (Addenda) 932
901 (*b*). lanceolatus Gmel. (Addenda) 932
297. Liostomus Lac 573
902. xanthurus Lac 574
298. Genyonemus Gill 574, 932
903. lineatus Ayres 574
299. Micropogon Cuv. & Val 575
904. undulatus L 575
300. Umbrina Cuvier 575
905. roncador J. & G 576
906. broussoneti C. & V 576
301. Menticirrus Gill 576
907. nebulosus Mitch 577
908. littoralis Holbr 577, 933
909. alburnus L 577
910. undulatus Grd 578
302. Larimus Cuv. & Val 578
911. fasciatus Holb 578
303 (304). Cynoscion Gill 579
§ *Atractoscion* Gill. (Addenda) 579
912. nobile Ayres 579
§ *Cynoscion* 579
913. parvipinne Ayres 580
914. nothum Holb 580
915. regale Bl. & Schn 581
916. thalassinum Holb 581
917. maculatum Mitch 581
305. Seriphus Ayres 582
918. politus Ayres 582
Family 92. Gerridæ 582
306. Gerres Cuvier 583, 935
§ *Gerres* 583
919. plumieri C. & V 583
919 (*b*). olisthostoma Goode & Bean. (Addenda) 934
§ *Diapterus* Ranz 583

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 92. Gerridæ.
920. gula C. & V. (Addenda) 584, 934
921. homonymus Goode & Bean 584
921 (*b*). cinereus Walb. (Addenda) 935
922. harengulus Goode & Bean 584
Family 93. Embiotocidæ 585
307. Hysterocarpus Gibbons 586
923. traski Gibbons 587
308. Abeona Girard 587
924. minima Gibbons 587
925. aurora Jor. & Gilb 588
308 (*b*). Brachyistius Gill. (Addenda) 589, 936
926. frenatus Gill 589
927. rosaceus Jor. & Gilb 589
309. Micrometrus Gibbons 588
928. aggregatus Gibbons 590
310. Holconotus Agassiz. (Addenda 590, 936
§ *Hypocritichthys* Gill 591
929. analis A. Agassiz 591
§ *Hyperprosopon* Gibb 591
930. argenteus Gibbons. (Addenda) 591
931. agassizii Gill 592
§ *Holconotus* Ag 592
932. rhodoterus Agassiz 592
310 (*b*). Amphistichus Agassiz 593
933. argenteus Agassiz 593
311. Hypsurus A. Agassiz 593
934. caryi Agassiz 593
312. Ditrema Schlegel 594
§ *Embiotoca* Ag 594
935. laterale Agassiz 594
936. jacksoni Agassiz 595
§ *Ditrema* 595
937. atripes Jor. & Gilb 595
938. furcatum Grd 596
313. Rhachochilus Agassiz 596
939. toxotes Agassiz 596
314. Damalichthys Grd 597
940. argyrosomus Grd 597
Family 94. Labridæ 597
315. Ctenolabrus Cuv. & Val 599
§ *Tautogolabrus* Gthr 599
941. adspersus Walb 599
316. Hiatula Lac. (Addenda) 599, 936
942. onitis Linn 600
317. Lachnolæmus Cuv. & Val 600
943. falcatus Linn 601
318. Harpe Lacépède 601
944. rufa Linn 601
318 (*b*). Trochocopus Gthr. (Addenda) 602, 936
§ *Pimelometopon* Gill 602
945. pulcher Ayres 602

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 94. Labridæ.
319. Platyglossus Bleeker 602
946. radiatus Linn 603
947, 948. bivittatus Bloch. (Addenda)..... 603, 936
948 (*b*). caudalis Poey. (Addenda) 937
949. semicinctus Ayres 603
320. Pseudojulis Bleeker 604
§ *Oxyjulis* Gill..... 604
950. modestus Grd 604
321. Xyrichthys Cuv. & Val..... 605
951. vermiculatus Poey..... 605
952. lineatus Cuv. & Val..... 605
322. Calliodon Gronow 606
953. ustus Cuv. & Val..... 606
323. Scarus Forsk. (Addenda)..... 606, 938
§ *Scarus*. (Addenda) 606, 938
954. guacamaia Cuv. and Val..... 607
954 (*b*). croicensis Bloch. (Addenda)..... 938
§ *Sparisoma* Sw. (Addenda)..... 938
954 (*c*). squalidus Poey. (Addenda) 938
954. (*d*). radians C. & V. (Addenda)..... 939
Family 95. Cichlidæ 607
324. Heros Heckel 608
955. cyanoguttatus B. & G 608
955 (*b*). pavonaceus Garm. (Addenda)..... 939
Family 96. Pomacentridæ 609
325. Pomacentrus Lac 609
§ *Pomacentrus* 610
956. leucostictus Müller & Troschel..... 610
§ *Hypsypops* Gill 610
957. rubicundus Grd 610
325 (*b*). Glyphidodon Lac. (Addenda)..... 610, 939
958. declivifrons Gill. (Addenda)..... 611
959. saxatilis Linn 611
326. Chromis L 611
§ *Furcaria* Poey. (Addenda)..... 939
960. punctipinnis Cooper 611
§ *Chromis* 611
961. insolatus Cuv. & Val..... 612
961 (*b*). enchrysurus J. & G. (Addenda) 940
Family 97. Ephippidæ 612
327. Chætodipterus Lac 613
962. faber Brouss 613
Family 98. Chætodontidæ..... 614
328. Chætodon Linn 614
963. maculocinctus Gill 615
963 (*b*). bimaculatus Bloch. (Addenda) 940
963 (*c*). capistratus L. (Addenda)..... 940
329. Pomacanthus Lac 615
§ *Holacanthus* Lac 615
964. ciliaris Linn..... 615
964 (*b*). tricolor Bloch. (Addenda)..... 941

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 98. Chætodontidæ.
§ *Pomacanthus* 615
965. arcuatus L 616
Family 99. Acanthuridæ 616
330. Acanthurus Bl. & Schn 617
966. chirurgus Bl. & Schn 617
966 (*b*). nigricans L. (Addenda) 941
966 (*c*). tractus Poey. (Addenda) 941
967. cœruleus Bl. & Schn 617
Family 100. Trachypteridæ 617
331. Trachypterus Gouan 618
968. altivelis Kner 618
Family 101. Icosteidæ 619
332. Icosteus Lock 620
969. ænigmaticus Lock 620
333. Icichthys J. & G 621
970. lockingtoni J. & G 621
334. Bathymaster Cope 622
971. signatus Cope 623
Family 102. Latilidæ 623
335. Lopholatilus G. & B 624
972. chamæleonticeps G. & B 624
336. Caulolatilus Gill 625
973. princeps Jen 625
974. chrysops C. & V 626
Family 102 (*b*). Trichodontidæ 626
337. Trichodon Steller 627
975. stelleri C. & V 627
Family 103. Uranoscopidæ 627
338. Astroscopus Brevoort 628
976. y-græcum C. & V 628
977. anoplus C. & V 629
Family 103 (*b*). Opisthognathidæ. (Addenda) 942
338 (*b*). Gnathypops Gill. (Addenda) 942
977 (*b*). maxillosus Poey. (Addenda) 942
338 (*c*). Opisthognathus C. & V. (Addenda) 943
977 (*c*). scaphiurus Goode & Bean. (Addenda) 943
977 (*d*). lonchurus J. & G. (Addenda) 943
Family 104. Gobiidæ 629
339. Gobiomorus Lac. (Addenda) 630, 972
978. dormitator Lac 631
340. Eleotris Gronow 631
979. gyrinus Cuv. & Val 631
341. Dormitator Gill 631
980 (981). maculatus Bloch. (Addenda) 632
341 (*b*). Culius Bleeker. (Addenda) 944
981 (*b*). amblyopsis Cope. (Addenda) 944
342.? Evorthodus Gill. (Addenda) 632
987. würdemanni Grd. (Addenda) 632
(343) 344. Gobius L 633
§ *Euctenogobius* Gill 633, 945
983. lyricus Grd 633
983 (*b*). encæomus J. & G. (Addenda) 945

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 104. Gobiidæ.
§ *Gobius* 633
984 (982, 985). soporator C. & V. (Addenda) 632, 634, 945
§ *Coryphopterus* Gill 635
987 (*b*). boleosoma J. & G. (Addenda) 946
987 (*c*). stigmaturus Goode & Bean. (Addenda) 946
987 (*d*). nicholsi Bean. (Addenda) 946
988. glaucofrænum Gill 635
345. Gobionellus Grd 635
989. oceanicus Pall 636
989 (*b*). stigmaticus Poey. (Addenda) 947
346. Gillichthys Cooper 636
990. mirabilis Cooper 636
347. Lepidogobius Gill 637
§ *Lepidogobius* 637
991. gracilis Grd 637
§ *Eucyclogobius* Gill 637
992. newberryi Grd 637
992 (*b*) (986). gulosus Grd. (Addenda) 634, 945
992 (*c*). thalassinus J. & G. (Addenda) 947
348. Gobiosoma Grd 638
993 (994). bosci Lac. (Addenda) 638, 948
994 (*b*). ios J. & G. (Addenda) 948
349. Typhlogobius Steind 639
995. californiensis Steind 639
350. Tyntlastes Gthr 639
996. sagitta Gthr 639
350 (*b*). Ioglossus Bean. (Addenda) 948
996 (*b*). calliurus Bean. (Addenda) 949
Family 105. Chiridæ 640
351 (*a*). Pleurogrammus Gill. (Addenda) 642, 949
997. monopterygius Pall 642
351 (*b*). Hexagrammus Steller 641
998. ordinatus Cope 642
999. asper Steller 643
999 (*b*). scaber Bean. (Addenda) 949
1000. superciliosus Pall 644
1001. decagrammus Pall 645
352. Ophiodon Grd 646
1002. elongatus Grd 646
353. Zaniolepis Grd 647
1003. latipinnis Grd 647
354. Oxylebius Gill 648
1004. pictus Gill 648
355. Myriolepis Lock 649
1005. zonifer Lock 649
356. Anoplopoma Ayres 649
1006. fimbria Pallas 650
Family 106. Scorpænidæ 650
357. Sebastes Cuvier 651
1007. marinus Linn 651
358. Sebastodes Gill 652

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 106. Scorpænidæ.
§ *Sebastodes* 656
1008. paucispinis Ayres 656
§ *Sebastosomus* Gill 657
1009. flavidus Ayres 657
1010. melanops Grd 658
1011. ciliatus Tiles 658
1012. mystinus Jor. & Gilb 659
1013. entomelas J. & G 659
1014. ovalis Ayres 660
1015. proriger J. & G 661
1016. atrovirens J. & G 662
1017. pinniger Gill 662
1018. miniatus J. & G 663
§ *Sebastomus* Gill 664
1019. ruber Ayres 665
1019 (*b*). umbrosus J. & G. (Addenda) 950
1020. constellatus J. & G 665
1021. rosaceus Grd 666
1022. rhodochloris J. & G 667
1023. chlorostictus J. & G 668
1024. elongatus Ayres 669
1025. rubrivinctus J. & G 669
§ *Sebastichthys* Gill 670
1026. auriculatus Grd 670
1027. rastrelliger J. & G 671
1028. caurinus Rich 672
1028 (*b*). vexillaris J. & G 672
1029. maliger J. & G 673
1030. carnatus J. & G 674
1031. chrysomelas J. & G 675
1032. nebulosus Ayres 676
1033. serriceps J. & G 676
1034. nigrocinctus Ayres 677
359. Scorpæna L 678
1035. dactyloptera De La Roche 679
1036. guttata Grd 679
1037. plumieri Bloch 680
1038 (*b*). stearnsi Goode & Bean. (Addenda) 951
1038 (*c*). calcarata Goode & Bean. (Addenda) 952
360. Setarches Johnson 682
1039. parmatus Goode 682
Family 107. Cottidæ 682
361. Hemitripterus Cuvier 685
1040. americanus Gm 685
1041. cavifrons Lock 686
362. Ascelichthys J. & G 686
1042. rhodorus J. & G 686
363. Psychrolutes Günther 686
1043. paradoxus Gthr 687
364. Cottunculus Collett 687
1044. microps Collett 688
1045. torvus Goode 688

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 107. Cottidæ.
365. Icelus Kröyer 689
§ *Artedius* Grd 689
1046. lateralis Grd 689
1047. notospilotus Grd 690
§ *Icelus* 690
1048. hamatus Kröyer 691
1049. quadriseriatus Lock 691
§ *Chitonotus* Lock 691
1050. megacephalus Lock 692
1051. pugettensis Steind 692
§ ——— .....
1052. uncinatus Reinh 693
1053. bicornis Reinh 693
366. Uranidea De Kay 693
§ *Tauridea* Jor. & Rice 694
1054. ricei Nelson. (Addenda) 694, 953
§ *Cottopsis* Grd 694
1055. aspera Rich 694
1056. semiscabra Cope 695
1056 (*b*). rhothea Rosa Smith. (Addenda) 953
§ *Potamocottus* Gill 695
1057. gulosa Grd 695
1058. punctulata Gill 696
1059. bendirei Bean 696
1060. richardsoni Agassiz 696
1061. wheeleri Cope 697
§ *Uranidea* 698
1062. cognata Rich 698, 953
1062 (*b*). spilota Cope. (Addenda) 954
1062 (*c*). pollicaris J. & G. (Addenda) 954
1063. minuta Pall 698
1064. marginata Bean 698
1065. viscosa Hald 698
1066. gracilis Heck 699
1067. gobioides Grd 699
1068. boleoides Grd 699
1069. franklini Ag 699, 954
1069 (*b*). formosa Grd. (Addenda) 955
1070. hoyi Putn 700
367. Cottus L. 700
1071. bubalis L 701
1072. octodecimspinosus Mitch 701
1073. æneus Mitch. 701
1074. scorpioides Fabr. 702
1075. scorpius L 702
1076. polyacanthocephalus Pall 703
1077. labradoricus Grd 704
1078. tæniopterus Kner 704
1079. quadricornis L 704
1080. humilis Bean 705
1081. jaok C & V 705

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 107. Cottidæ.
1082. axillaris Gill 706
1083. polaris Sab 706
1084. platycephalus Pall 706
1085. verrucosus Bean 707
1086. niger Bean 707
1087. quadrifilis Gill 707
368. Gymnacanthus Sw 708
1088. pistilliger Pall 708
1089. galeatus Bean 709
369. Triglopsis Grd 709
1090. thompsoni Grd 709
370. Enophrys Sw 710
1091. bison Grd 710
1092. diceraus Pall 711
1093. claviger C. & V 711
371. Liocottus Grd 711
1094. hirundo Grd 712
872. Triglops Reinh 712
1095. pingeli Reinh 713
373. Leptocottus Grd 713
1096. armatus Grd 713
374. Hemilepidotus Cuv 714
1097. spinosus Ayr 714
1098. jordani Bean 715
1099. trachurus Pall 715
375. Melletes Bean 716
1100. papilio Bean 716
376. Scorpænichthys Grd 716
1101. marmoratus Ayr 716
377. Oligocottus Grd 717
§ *Clinocottus* Gill 717
1102. analis Grd 717
§ *Oligocottus* 718
1103. maculosus Grd 718
§ *Blennicottus* Gill 718
1104. globiceps Grd 718
378. Blepsias Cuv 719
1105. cirrhosus Pall 719
1106. bilobus C. & V 720
379. Nautichthys Grd 720
1107. oculofasciatus Grd 721
380. Rhamphocottus Gthr 721
1108. richardsoni Gthr 722
Family 108 (*a*). Agonidæ 722
381. Aspidophoroides Lac 724
1109. monopterygius Bloch 724
1110. inermis Gthr 725
382. Siphagonus Steind 725
1111. barbatus Steind 725
383. Leptagonus Gill. (Addenda) 726, 955

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 108 (*a*). Agonidæ.
§ *Brachyopsis* Gill 726
1112. rostratus Tiles 726
1113. verrucosus Lock 726
1114. xyosternus J. & G 727
§ *Leptagonus* (Addenda) 955
1115. decagonus B. & S 727, 955
[384. Agonus B. & S] 728
[1116. cataphractus L] 728
385. Bothragonus Gill 728
1117. swani Steind 729
386. Odontopyxis Lock 729
1118. trispinosus Lock 729
387. Podothecus Gill 729
1119. vulsus J. & G 730
1120. acipenserinus Tiles 730
Family 108 (*b*). Triglidæ 731
388. Peristedium Lac 732
1121. miniatum Goode 732
[389. Trigla L.] 733
[1122. cuculus L.] 733
390. Prionotus Lac 733
§ *Ornichthys* Sw 734
1123. scitulus J. & G. (Addenda) 734, 956
1123 (*b*). punctatus Bl. (Addenda) 956
1124. palmipes Mitch 734
§ *Prionotus* 735
1125. tribulus C. & V 735
1126. evolans L 735
1127. stephanophrys Lock 736
391. Cephalacanthus Lac 737
1128. volitans L. (Addenda) 738, 957
Family 109. Liparididæ 738
392. Amitra Goode 739
1129. liparina Goode 739
393. Careproctus Kröy 740
1130. gelatinosus Pall 740
1130 (*b*). reinhardi Kröy. (Addenda) 957
394. Liparis L 740
§ *Actinochir* Gill 741
1131. major Walb 741
§ *Liparis* 740
1132. pulchella Ayr 741
1133. gibba Bean 741
1135. tunicata Reinh 742
1136 (1134). lineata Lepechin 742
1137. ranula G. & B 742
1138. montagui Don 743
1139. calliodon Pall 743
1140. cyclopus Gthr 743
§ *Neoliparis* Steind 744
1141. mucosa Ayr 744

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 110. Cyclopteridæ 744
395. Cyclopterichthys Steind 745
1142. ventricosus Pall 745
1143. stelleri Pall 745
395 (*b*). Eumicrotremus Gill. (Addenda) 746, 957
1144. spinosus Müll 746
396. Cyclopterus L 746
1145. lumpus L 747
Family 111. Gobiesocidæ 747
397. Gobiesox Lac 748
1146. reticulatus Grd 749
1147. strumosus Cope 749
1147 (*b*). virgatulus J. & G. (Addenda) 957
1148. rhessodon R. Smith 749
Family 112. Batrachidæ 750
398. Batrachus B. & S 750
1149. tau L 750
1149 (*b*). pardus G. & B 751
399. Porichthys Grd 751
1150. margaritatus Rich. (Addenda) 751, 958
1150 (*b*). plectrodon J. & G. (Addenda) 958
Family 113. Leptoscopidæ 752
400. Dactyloscopus Gill 753
1151. tridigitatus Gill 753
Family 114. Blenniidæ 753
401. Ophioblennius Gill 756
1152. webbi Val 756
402. Chasmodes C. & V 756
1153. bosquianus Lac 756
1154. quadrifasciatus Wood 757
1154 (*b*). saburræ J. & G. (Addenda) 958
403. Isesthes J. & G 757
1155. gilberti Jor. (Addenda) 757, 959
1155 (*b*). gentilis Grd. (Addenda) 959
1156. punctatus Wood 758
1156 (*b*). hentzi Le S. (Addenda) 960
1156 (*c*). ionthas J. & G. (Addenda) 960
1156 (*d*). scrutator J. & G. (Addenda) 960
404. Hypleurochilus Gill 758
1157. multifilis Grd 758
1158. geminatus Wood 759
405. Blennius L 759
§ *Blennius* 759
[1159. fucorum C. & V.] 759
1159 (*b*). stearnsi J. & G. (Addenda) 961
1159 (*c*). favosus Goode & Bean. (Addenda) 961
1159 (*d*). asterias Goode & Bean. (Addenda) 961
§ *Pholis* Cuv 760
1160. carolinus C. & V 760
406. Neoclinus Grd 760
1161. satiricus Grd 761
1162. blanchardi Grd 761
407. Clinus Cuv 761

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 114. Blenniidæ.
§ *Labrosomus* Sw 762
1163. nuchipinnis Q. & G 762
§ *Gibbonsia* Coop 763
1164. evides J. & G 763
408. Heterostichus Grd 763
1165. rostratus Grd 764
409. Cremnobates Gthr 764
1166. integripinnis R. Smith 764
1166 (*b*). marmoratus Steind. (Addenda) 962
410. Chirolophus Sw 765
1167. polyactocephalus Pall 765
411. Murænoides Lac 766
§ *Murænoides* 767
1168. gunnellus L 767
1169. fasciatus B. & S 767
1170. ornatus Grd 767
1171. maxillaris Bean 768
1172. dolichogaster Pall 768
§ *Asternopteryx* Rüpp 769
1173. gunelliformis Rüpp 769
412. Apodichthys Grd 769
1174. flavidus Grd 769
1175. fucorum J. & G 770
413. Anoplarchus Gill 770
1176. atropurpureus Kittl 771
1177. alectrolophus Pall 771
414. Xiphister Jor 771
1178. chirus J. & G 772
1179. mucosus Grd 772
1180. rupestris J. & G 773
415. Cebedichthys Ayres 773
1181. violaceus Grd 774
416. Eumesogrammus Gill 774
1182. præcisus Kröy 774
1183. subbifurcatus Stor 775
417. Stichæus Reinh 775
1184. punctatus Fabr 775
418. Notogrammus Bean 776
1185. rothrocki Bean 776
419. Lumpenus Reinh 776
§ *Leptoclinus* Gill 777
1186. maculatus Fries 777
§ *Anisarchus* Gill 777
1187. medius Reinh 777
§ *Lumpenus* 777
1188. anguillaris Pall 777
1189. fabricii C. & V 778
420. Leptoblennius Gill 778
1190. nubilus Rich 778
1191. serpentinus Stor 778
1192. lampetræformis Walb 779

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 114. Blenniidæ.
421. Delolepis Bean 779
1193. virgatus Bean 779
422. Cryptacanthodes Stor 780
1194. maculatus Stor 780
423. Anarrhichas L 781
1195. lupus L 781
1196. minor Olafs 781
1197. latifrons Steenstrup & Halgrimsson 782
1198. lepturus Bean 782
424. Anarrhichthys Ayres 782
1199. ocellatus Ayr 782
Family 115. Lycodidæ 783
425. Zoarces Cuv 784
1200. anguillaris Peck 784
426. Lycodopsis Coll 784
1201. pacificus Coll 785
1202. paucidens Lock 785
427. Lycodes Reinh 785
1203. paxillus G. & B 785
1204. verrilli G. & B 786
1205. vahli Reinh 786
1206. esmarki Coll 786
1207. reticulatus Reinh 787
1208. seminudus Reinh 787
1209. nebulosus Kröy 787
1210. coccineus Bean 787
428. Lycodalepis Bleeker 788
1211. mucosus Rich 788
1212. turneri Bean 788
1213. polaris Sab 788
429. Gymnelis Reinh 789
1214. viridis Fabr 789
1215. stigma Benn 789
430. Uronectes Gthr 789
1216. parrii Ross 789
Family 116 Congrogadidæ 790
431. Scytalina J. & G 790
1217. cerdale J. & G 790
Family 117. Fierasferidæ 791
432. Fierasfer Cuv 791
1218. dubius Putn 791
Family 118. Ophidiidæ 792
433. Ophidium L 792
§ *Ophidium* 792
1219. marginatum Dek 792
1220. josephi Grd 793
1221. holbrooki Putn 793
1221 (*b*). graëllsi Poey. (Addenda) 963
1222. taylori Grd 793
§ *Leptophidium* Gill 793
1223. profundorum Gill 793
433 (*b*). Genypterus Philippi. (Addenda) 963
1223 (*b*). omostigma J. & G. (Addenda) 963

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 120 (119). Gadidæ 794
434. Bythites Reinh 795
1224. fuscus Reinh 795
435. Dinematichthys Bleek 795
§ *Brosmophycis* Gill. (Addenda) 796, 963
1225. marginatus Ayres 796
436. Onos Risso 796
§ *Rhinonemus* Gill 797
1226. cimbrius L 797
§ *Onos* 797
1227. reinhardti Kröy 797
1228. ensis Reinh 797
437. Phycis B. & S 798
1229. regius Walb 798
1230. earlli Bean 798
1231. chuss Walb 799
1232. tenuis Mitch 799
1233. chesteri G. & B 799
438. Haloporphyrus Gthr 800
1233 (*b*). viola G. & B 800
439. Physiculus Kaup 800
1234. dalwigkii Kaup 801
440. Molva Nilss 801
1235. vulgaris Flem 801
441. Lota Cuv 801
1236. maculosa Le S 802
442. Brosmius Cuv 802
1237. brosme Müll 802
443. Gadus L 803
§ *Melanogrammus* Gill 803
1238. æglifinus L 803
§ *Gadus* 804
1239. callarias L 804
§ *Tilesia* Sw 804
1240. gracilis Tiles 804
§ *Microgadus* Gill 805
1241. proximus Grd 805
1242. tomcod Walb 806
§ *Pollachius* Nilss 806
1243. virens L 806
1244. chalcogrammus Pall 807
§ *Boreogadus* Gthr 807
1245. saida Lepechin 807
444. Hypsicometes Goode 808
1246. gobioides Goode 808
445. Merlucius Raf 808
1247. bilinearis Mitch 809
1248. smiridus Raf 809
1249. productus Ayres 809
Family 120 (*b*). Chiasmodontidæ. (Addenda) 964
446. Chiasmodon Johns 810
1250. niger Johns 810

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order T. Acanthopteri.
Family 121. Macruridæ ... 810
447. Macrurus Bloch ... 811
1251. fabricii Sundev ... 811
1252. carminatus Goode ... 812
1253. bairdi G. & B ... 812
448. Coryphænoides Gunner ... 812
1254. rupestris Gunner ... 812
Order U. Heterosomata ... 813
Family 122 (123). Pleuronectidæ ... 813
449. Bothus Raf ... 815
1255. maculatus Mitch ... 815
450. Citharichthys Bleek ... 816
§ *Hemirhombus* Bleek ... 816
1256. pætulus Goode & Bean. (Addenda) ... 816, 964
1256 (*b*). ocellatus Poey. (Addenda) ... 817, 964
§ *Citharichthys* ... 817
1257. sordidus Grd ... 817
1257 (*b*). stigmæus J. & G. (Addenda) ... 965
1258. spilopterus Gthr ... 817
1259. arctifrons Goode ... 818
1260. unicornis Goode ... 818
451. Hippoglossus Cuv ... 818
1261. vulgaris Flem. ... 819
452. Platysomatichthys Bleek ... 819
1262. hippoglossoides Walb ... 819
453. Atheresthes J. & G ... 820
1263. stomias J. & G ... 820
454. Paralichthys Grd ... 821
§ *Paralichthys* ... 821
1264 californicus Ayr ... 821
1265. ocellaris Dek. (Addenda) ... 822, 972
1266. dentatus L ... 822
1267. albigutta J. & G ... 823
1268. squamilentus J. & G ... 823
1269. oblongus Mit ... 824
1270. ommatus J. & G ... 824
§ *Xystreurys* J. & G ... 825
1271. liolepis J. & G ... 825
455. Hippoglossoides Gottsche ... 825
§ *Hippoglossoides* ... 826
1272. platessoides Fabr ... 826
1273. elassodon J. & G ... 826
1274. jordani Lock ... 827
1275. exilis J. & G ... 827
§ *Psettichthys* Grd ... 828
1276. melanostictus Grd ... 828
456. Pleuronichthys Grd ... 828
1277. decurrens J. & G ... 829
1278. verticalis J. & G ... 829
1279. cœnosus Grd ... 830
457. Hypsopsetta Gill ... 830
1280. guttulata Grd ... 830

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order U. Heterosomata.
Family 122 (123). Pleuronectidæ.
458. Pleuronectes L 831
§ *Parophrys* Grd 831
1281. vetulus Grd 831
§ *Isopsetta* Lock 832
1282. isolepis Lock 832
1283. ischyrus J. & G 832
§ *Lepidopsetta* Gill 833
1284. bilineatus Ayr 833
§ *Limanda* Gottsche 834
1285. ferrugineus Stor 834
1286. asper Pall 835
1287. beani Goode 835
§ *Platichthys* Grd 835
1288. stellatus Pall 835
§ *Pleuronectes* 836
1289. quadrituberculatus Pall 836
1290. glaber Stor 836
1291. glacialis Pall 837
§ *Pseudopleuronectes* Bleek 837
1292. americanus Walb 837
459. Glyptocephalus Gottsche 837
1293. cynoglossus L 838
1294. zachirus Lock 838
460. Cynicoglossus Bonap 838
1295. pacificus Lock 839
461. Etropus J. & G 839
1296. crossotus J. & G 839
462. Thyris Goode 840
1297. pellucidus Goode 840
463. Monolene Goode 840
1298. sessilicauda Goode 841
463 (*b*). Bæostoma Bean. (Addenda) 965
1298 (*b*). brachiale Bean. (Addenda) 965
464. Achirus Lac 841
1299. lineatus L 841
465. Aphoristia Kaup 842
1300. atricauda J. & G 842
1301. plagiusa L 843
Order V. Pediculati 843
Family 124. Lophiidæ 844
466. Lophius L 844
1302. piscatorius L 844
Family 125 (*a*). Antennariidæ 845
466 (*b*). Pterophrynoides Gill 845
1303. histrio L 845
467. Antennarius Lac 845
1304. annulatus Gill 846
1305. pleurophthalmus Gill 846
468. Chaunax Lowe 846
1306. pictus Lowe 847
Family 125 (*b*.) Ceratiidæ .....
469. Ceratias Kröyer 847

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order V. Pediculati.
Family 125 (*b*). Ceratiidæ.
1307. holbölli Kröy 847
470. Mancalias Gill 848
1308. uranoscopus Murray 848
471. Onirodes Lütk 848
1309. eschrichti Lütk 848
472. Himantolophus Reinh 849
1310. grœnlandicus Reinh 849
1311. reinhardti Lütk 849
Family 126. Malthidæ 849
473. Malthe Cuv 850
1312. vespertilio L 850
1313. cubifrons Rich 850
474. Halieutichthys Poey 851
1314. aculeatus Mitch 851
475. Halieutæa C. & V. 851
1315. senticosa Goode 851
Order W. Plectognathi 852
Family 127. Ostraciidæ 852
476. Ostracium L 853
§ *Lactophrys* Sw 853
1316. trigonum L 853
1316 (*b*). triquetrum L. (Addenda) 965
1317. quadricorne L 854
Family 128. Balistidæ 854
477. Balistes L 854
1318. vetula L 855
1319. capriscus Gmel 855
1320. poweli Cope 855
478. Monacanthus Cuv 856
§ *Monacanthus* 856
1321. occidentalis Gthr 856
§ *Stephanolepis* Gill 856
1322. hispidus L. (Addenda) 856, 965
1323. davidsoni Cope 857
1324. spilonotus Cope 857
§ *Cantherines* Sw 858
1325. pullus Ranz 858
479. Alutera Cuv 858
1326. schœpffi Walb 858
1327. scripta Osb 859
Family 129. Tetrodontidæ 859
480. Lagocephalus Sw 859
1328. lævigatus L 860
481. Tetrodon L 860
1329. politus Grd 860
1330. testudineus L 861
1331. spengleri Bl 861
1332. turgidus Mitch 861
1332 (*b*). nephelus Goode & Bean. (Addenda) 966
1333. trichocephalus Cope 862
482. Trichodiodon Bleek 862
1334. pilosus Mitch 862

Class IV. Pisces—continued. Page.
Subclass Physoclisti.
Order W. Plectognathi.
Family 129. Tetrodontidæ.
483. Diodon L 862
1335. hystrix L 863
1336. liturosus Shaw. (Addenda) 863, 966
484. Chilomycterus Bibron 863
1337. geometricus B. & S 863
1337 (*b*). fuliginosus Dek 864
1337 (*c*). reticulatus L. (Addenda) 966
Family 130. Orthagoriscidæ 864
485. Molacanthus Sw 865
1338. nummularis Walb 865
486. Mola Cuv 865
1339. rotunda Cuv 865
487. Ranzania Nardo. (Addenda) 966
1340. truncata Retz. (Addenda) 966

LIST OF NEW GENERA AND SPECIES.

The following specific and generic names appear as new in the present work. A number of other descriptions of new species in the Addenda are abridged from manuscripts and proof-sheets of the current volume of the Proceedings of the United States National Museum. It is probable that in all cases the date of their publication in these proceedings will be previous to the issue of the present volume.

	Page.
Minnilus scepticus J. & G	200
Platygobio pallidus Forbes	220
Trycherodon Forbes	247
Trycherodon megalops Forbes	247
Coregonus kennicotti Milner	298
Fundulus adinia J. & G	335
Euthynnus Lütken	429
Lepomis symmetricus Forbes	473
Cottogaster putnami J. & G	498
Pœcilichthys butlerianus Hay	519
Bothragonus Gill	728
Cottunculus torvus Goode	688
Isesthes J. & G	757
Clinus evides J. & G	763
Paralichthys ophryas J. & G	822
Paralichthys ommatus J. & G	824
Isopsetta Lockington	832
Petromyzon marinus dorsatus Wilder	868
Galeorhinus zyopterus J. & G	870
Fundulus zebrinus J. & G	891
Menidia laciniata Swain	908
Menidia audens Hay	908
Xenistius J. & G	920
Creolus J. & G	

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A SYNOPSIS OF THE FISHES OF NORTH AMERICA.

Ichthyology (ἰχθύς, fish; λόγος, a discourse) is the science of fishes. A "fish," in the popular sense, is a member of any one of the four classes of aquatic or fish-like vertebrates, the groups here designated as *Pisces*, *Elasmobranchii*, *Marsipobranchii*, and *Leptocardii*. A fish, in this comprehensive and somewhat indefinite sense, may be defined as a cold-blooded vertebrate, adapted for life in the water; breathing by means of gills; having the limbs, if present, developed as fins; the fingers and toes being represented by cartilaginous rays connected by membrane; the exoskeleton obsolete or developed as scales or bony plates; and one or more fins developed on the median line of the body, usually composed of rays connected by membrane.

Of a "fish" in the popular sense one could hardly say more, without the necessity of the constant introduction of exceptions. Of a "true fish," a fish in a strict zoölogical sense,—that is, a member of the class *Pisces*,—a definition will be given further on.

Among the fish-like vertebrates, the writers, following Professor Gill and other eminent authorities, recognize four classes, considered as co-ordinate with the classes *Batrachia*, *Reptilia*, *Aves*, and *Mammalia*. These four classes have been thus limited and characterized:

ANALYSIS OF THE CLASSES OF FISH-LIKE VERTEBRATES.

* Skull undeveloped, with the notochord persistent and extending to the anterior end of the head. Brain not distinctly differentiated. Heart none.

LEPTOCARDII, 1.

** Skull more or less developed, with the notochord not continued forward beyond the pituitary body. Brain differentiated and distinctly developed. Heart developed and divided at least into an auricle and a ventricle.

† Skull imperfectly developed, and with no lower jaw. Paired fins undeveloped, with no shoulder-girdle nor pelvic elements. Gills purse-shaped,

MARSIPOBRANCHII, 2.

†† Skull well developed and with a lower jaw. Paired fins developed (sometimes absent through atrophy); and with a shoulder-girdle (lyriform or furcula-shaped, curved forward and with its respective sides connected below), and with pelvic elements. Gills not purse-shaped. (LYRIFERA.)

‡ Skull without membrane bones (a "rudimental opercular bone" in *Chimæra*); gills not free, the branchial openings slit-like, usually several in number; exoskeleton placoid, sometimes obsolete; eggs few and large.

ELASMOBRANCHII, 3.

‡‡ Skull with membrane bones; gills free; branchial openings a single slit on each side, sometimes confluent; exoskeleton various, not placoid; eggs comparatively small and numerous ....PISCES, 4.

CLASS I.—LEPTOCARDII.

(*The Lancelets.*)

Skeleton membrano-cartilaginous; skull undeveloped, with the notochord persistent and extending to the anterior end of the head. Brain not differentiated. No heart; the function of the heart being performed by pulsating sinuses. Blood colorless. Respiratory cavity confluent with the cavity of the abdomen; branchial clefts in great number, the water being expelled through an abdominal pore in front of the vent. Jaws none; the mouth a longitudinal fissure, with cirri on each side.

Small marine animals highly interesting to the zoölogist as exhibiting the lowest degree of development of the vertebrate type. The class includes but the single order *Cirrostomi*. (λεπτός, thin; καρδία, heart.) (Subclass *Leptocardii* Günther, viii, 513–514.)

ORDER A.—CIRROSTOMI.

(*The Cirrostomes.*)

This order is equivalent to the family *Branchiostomatidæ*. (Latin, *cirrus*, a lock of hair; στόμα, mouth: the mouth being surrounded by a fringe of cirri.) (*Cirrostomi* Günther, viii, 513–514.)

FAMILY I.—BRANCHIOSTOMATIDÆ.

(*The Lancelets.*)

Body elongate, compressed, naked, colorless, with no fins, except a rayless fold extending along the back, around the tail, past the vent, to the abdominal pore. Mouth inferior, appearing as a longitudinal fissure, surrounded by conspicuous, rather stiff cirri. Eye rudimentary. Liver reduced to a blind sac of the simple intestine.

Genera two, *Branchiostoma* and *Epigonopterus*, differing chiefly in

the greater development of the dorsal fin in the latter. Species four or more, found imbedded in the sand on various coasts. (*Cirrostomi* Gthr. viii, 513–514.)

* Dorsal fold very low, nearly uniform ..... BRANCHIOSTOMA, 1.

1.—BRANCHIOSTOMA Costa, 1834.

Lancelets.

(*Amphioxus* Yarrell.)

(Costa, Cenni Zoologici Napol. 1834, p. 49: type *Branchiostoma lubricum* Costa = *Limax lanceolatus* Pallas.)

The characters of this genus are essentially those of the family as given above, the little development of the fins constituting its chief distinctive character. (*βράγχια*, gills; *στόμα*, mouth.)

1. B. caribæum Sundevall.—*American Lancelet.*

This species occurs in abundance, buried in the sand in shallow waters, along the American coast, from the mouth of Chesapeake Bay to the West Indies. It has never been fully compared with *B. lanceolatum* and other species of the genus.

(*Branchiostoma caribæum* Sundevall, Oefvers. Vet. Akad. Förhandl. 1853, 11.)

CLASS II.—MARSIPOBRANCHII.

(*The Myzonts.*)

Skeleton cartilaginous; the skull imperfectly developed, not separate from the vertebral column. No ribs, no true jaws, no limbs, no shoulder-girdle, nor pelvic elements. Gills in the form of fixed sacs, without branchial arches, six or more in number on each side. A single nasal aperture. Mouth subinferior, suctorial, nearly circular. Heart without arterial bulb. Alimentary canal straight, simple, without cæcal appendages, pancreas, or spleen. Generative outlet peritoneal. Vertical fins with feeble rays, continuous around the tail. Naked, eel-shaped animals, inhabiting all waters. (*μαρσίπιον*, a small pouch or purse; *βράγχια*, gills.) (Subclass *Cyclostomata* Günther, viii, 499–512.)

ORDERS OF MARSIPOBRANCHII.

* Nasal duct tube-like, with cartilaginous rings, penetrating the palate.
HYPEROTRETA, B.

** Nasal duct a blind sac, not penetrating the palate ..... HYPEROARTIA, C.

Order B.—HYPEROTRETA.

(*The Myxinoid Fishes.*)

Nostril tube-like, with cartilaginous rings, penetrating the palate, its position at the extremity of the head, over the mouth; snout with eight barbels; mouth without lips; one median tooth on the palate and two comb-like series of teeth on the tongue. Branchial apertures at a great distance from the head; a series of mucous sacs along each side of the abdomen. Intestine without spiral valve. Eggs large, with a horny case provided with threads for adhesion. Marine lamprey-like animals, burrowing into the flesh of fishes, on which they feed.

There is but one family, *Myxinidæ*, unless we assign separate rank to *Bdellostoma* on account of the difference in the gill-openings. (ὑπερώα, palate; τρητὸς, perforate.) (Family *Myxinidæ* Günther, 510–512.)

Family II.—MYXINIDÆ.

(*The Hag-fishes.*)

The characters of the family are included above. Genera two; species few; marine animals, found in all temperate seas. (*Myxinidæ* Günther, viii, 510–512.

* Branchial apertures one on each side, leading by six ducts to six branchial sacs. Myxine, 2.

** Branchial apertures six or more on each side, each leading directly to a branchial sac.....Bdellostoma, 3.

2.—MYXINE Linnæus, 1758.

Hag-fishes.

(Linnæus, Systema Naturæ: type *Myxine glutinosa* L.)

Body eel-shaped, covered by a thin skin, which is easily detached. Along the lower side, for nearly the whole length of the animal, are two rows of mucous glands, each with an external opening, from which exudes a quantity of mucus which renders these animals during life excessively slimy. No eyes. Brain small, of the normal fish type. Skull little developed, cartilaginous; the flexible notochord enclosed in its sheath, and extending from the base of the skull to the end of the

tail representing the spinal column. Mouth round, suctorial, without lips, with a pair of barbels on each side. Nostril single, large, on the median line above, and at the very front of the head, provided with two pairs of barbels. Teeth strong, a single median one on the roof of the mouth, and two rows on each side of the tongue, which is a powerful organ, with a strong fibrous tendon moving in a muscular sheath. Alimentary canal a simple, nearly straight tube. Gill-sacs placed on each side of the œsophagus, lying directly against its outer walls. The water passes into them by a small pore opening directly from the œsophagus into each sac. It is then passed out by a duct, which continues backward along the outer walls of the sacs to the abdominal wall at the end of the last sac, where all the ducts from one side unite in one, and the water is emptied at the branchial opening on each side of the median line. In close connection with the branchial opening on the left side there is a third opening that leads by a very short duct to the œsophagus, and hence into the branchial sacs, at times when the supply through the mouth is cut off by the head being buried in the food of the animal. Ovary single, on the right side. No oviducts; the mature eggs falling into the abdominal cavity are excluded through the peritoneal opening at the side of the vent.—(*Putnam.*)

A single species; colorless, parasitic animals, burrowing into the bodies of fishes, and found in all temperate seas. (*μύξα*, slime.)

2. M. glutinosa L.—*Hag-fish; Borer; Sleepmarken.*

Blue above, whitish below; head 3½ to 4 in total length; tail 6½ to 10 times in total length; lingual teeth 8 to 11 in each row (*Putnam*). Coasts of Europe and America; not abundant on our shores.

(L. Syst. Naturæ; Günther, viii, 510; Putnam, Proc. Bost. Soc. Nat. Hist. 1873, 135: *Myxine limosa* Girard, Proc. Ac. Nat. Sci. Phila. 1858, 223.)

3.—BDELLOSTOMA Müller, 1834.

(Müller, Abhandl. Akad. Wiss. Wien, 1834, 79: type *Petromyzon cirrhatus* Forster.)

This genus differs from *Myxine* chiefly in the structure of the branchial apparatus, there being six or more sacs on each side which receive water directly from the œsophagus as in *Myxine*, but the emptying ducts, instead of passing backward and downward to a common external opening, as in *Myxine*, pass directly through the wall of the body, so that there are as many external openings as there are gill-sacs. Warm seas. (*βδέλλος*, leech; *στόμα*, mouth.)

3. B. stouti* Lockington.

"Eleven gill openings on each side; ten teeth in the anterior and nine in the posterior series. Fifteen inches long."—(*Lockington.*) Coast of California; not rare.

(Lockington, Amer. Nat. Dec. 1878, 793.)

Order C.—HYPEROARTIA.

(*The Lampreys.*)

Nasal duct a blind sac, not penetrating the palate. This order is equivalent to the single family *Petromyzontidæ.* (ὑπερώα, palate; ἀρτιος, complete; *i. e.*, entire.) (*Petromyzontidæ* Günther, 499–509.)

Family III.—PETROMYZONTIDÆ.

(*The Lampreys.*)

Body eel-shaped, naked, subcylindrical anteriorly, compressed behind; mouth nearly circular, suctorial, armed with horny teeth, which are simple or multicuspid, resting on papillæ; those immediately above and those immediately below the opening of the œsophagus more or less specialized; eyes present; branchial openings seven, arranged in a linear series along the sides of the "chest"; nostril on the top of the head; lips present, usually fringed; dorsal fin more or less deeply divided by a notch; the posterior part commonly continuous with the anal around the tail; intestines with a spiral valve; eggs small.

These animals undergo a metamorphosis; the young are usually toothless and have the eyes rudimentary. Such forms have, until lately, been considered as forming separate genera, which have been termed *Ammocœtes*, *Scolecosoma*, *Chilopterus*, etc.

Genera 5 or 6; species 15 or 20; found in all waters in temperate regions. They attach themselves to fishes and feed by scraping off the flesh with their rasp-like teeth. Among our species, four groups, apparently of generic value, may be recognized, but the characters in

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* This species may be identical with *B. polytrema* Grd. from Chili, incorrectly described in Proc. Ac. Nat. Sci. Phila. 1854, 199, and thus characterized by Putnam, Proc. Bost. Soc. Nat. Hist. 1873, 160:

"Head about one third of total length, and contained about 1½ times in the length of the abdomen. Tail contained 7 to 8 times in total length. *Base of tongue between the seventh or eighth pair of gills. Gills ten on each side.* Length from 13 to 22 inches. Habitat: Coast of Chili."

several instances need verification, especially in regard to the lingual dentition. (*Petromyzontidæ* Günther, viii, 499–509.)

* Second dorsal continuous with the caudal.
  a. Maxillary tooth single, forming a crescent-shaped plate, with a distinct cusp at each end, between which is sometimes a median cusp.
    b. Dorsal fins two, well separated (lingual teeth pectinate) ..... LAMPETRA, 4.
    bb. Dorsal fin continuous, merely emarginate (lingual teeth obscurely tricuspidate) ..... AMMOCŒTES, 5.
  aa. Maxillary tooth double or triple, composed of two or three pointed cusps, close together, not forming a crescent-shaped plate (lingual teeth in two pairs, the posterior pair at least pectinate).
  c. Dorsal fin continuous ..... ICHTHYOMYZON, 6.
  cc. Dorsal fins entirely separated ..... PETROMYZON, 7.

4.—LAMPETRA Gray, 1851.

Lamperns.

(Gray, Chondropterygians, 140: type *Petromyzon fluviatilis* L.)

Lampreys of rather small size, with the maxillary tooth single, developed as a broad crescent-shaped plate, with a cusp at each end of it, the two separated by a broad interspace, in the middle of which is sometimes a smaller cusp. Dorsal fin divided by a deep notch, which breaks the continuity of the fin; second dorsal connected with the caudal; mandibulary plate well developed, the number and arrangement of its teeth varying with the species; lingual teeth finely pectinate; lips usually conspicuously fringed. The species are little known. One of them, *L. fluviatilis*, is European, and is closely related to *L. plumbea;* the other described species are American. (Latin, *lampetra*, a lamprey, from *lambere*, to suck; *petra*, stone.)

* Maxillary tooth tricuspid, a small median cusp being present; mandibulary cusps comparatively few and weak. (*Entosphenus* Gill.)
  † Mandibulary plate with five cusps, the middle ones smaller.
    ‡ Lips fringed with conspicuous papillæ.

4. L. tridentata (Gairdner) J. & G.—*Three-toothed Lamprey.*

Lips thick, fringed with numerous papillæ, each papilla standing in the middle of a little circular depression having a raised margin, which is partly concealed by a rugose tessellated plate investing the inner surface of the lips, and of the same horny nature with that which forms the outside of the teeth; both are softened and peel off in spirits. Four small, acute, conical teeth stand in a row across the upper part of this plate, and four larger ones occupy each of its sides, the upper and lower pairs being bicuspid and the middle ones tricuspid; these stand on the

sides of the maxillary ring or inner orifice, and have their ends turned toward it; the inferior margin of this orifice is armed with a slightly curved dental piece, having five acute points or teeth (the outer being larger than the three middle); opposite to it on the upper side of the orifice is another piece having two large, acutely conical teeth, with a smaller central one. The tongue is also clothed with a horny-looking substance, which is edged anteriorly by a row of about twenty fine teeth. The dorsal fins rise in even curves, which are highest in the middle; the first is about one third of its own length from the second. Back and sides bluish gray, with irregularly scattered yellowish patches; belly yellowish white. Size rather large.—(*Richardson.*) Pacific coast of North America, ascending streams.

(*Petromyzon tridentatus* Gairdner, MSS.; Richardson, F. B. A. 293: *Petromyzon ciliatus* Ayres, Proc. Cal. Ac. Sci. 1854, 44: *Petromyzon ciliatus* et *lividus* Grd. Pac. R. R. Surv. 378, 379: *Ichthyomyzon tridentatus* Gthr. viii, 506.)

‡‡ Lips without fringes of papillæ.

5. L. epihexodon (Gill) J. & G.—*Six-toothed Lamprey.*

This species is said to differ from *L. tridentata* in the absence of a fringe of papillæ around the buccal disk, and in the presence of six instead of four teeth in the upper transverse row.—(*Girard.*) Sacramento River.

(*Petromyzon tridentatus* Grd. Pac. R. R. Surv. 377; not Rich.: *Entosphenus epihexodon* Gill, Proc. Ac. Nat. Sci. Phila. 1862, 33.)

†† Mandibulary plate with six cusps, which are nearly equal in size.

6. L. astori (Grd.) J. & G.

Lips fringed; head 6½ in length; first dorsal lower than the second, separated from it by a space nearly equal to a third of its length; no anal fin; yellowish brown, darker above.—(*Girard.*) Astoria, Oregon.

(*Petromyzon astori* Girard, Pac. R. R. Surv. 380: *Ichthyomyzon astori* Günther, viii, 507.)

** Maxillary plate bicuspid, the small median cusp wanting; mandibulary plate with about eight rather strong, subequal teeth. (*Lampetra.*)

7. L. plumbea (Ayres) Gill.—*Lead-colored Lamprey.*

Lips fringed; head 8½ in length; first dorsal much lower than the second, and separated from it by a space equal to half of its own length; tail tapering to a point; a single bicuspid tooth on each side of the orifice of the mouth. Pacific coast; a small species, scarcely distinguishable from the European *L. fluviatilis.*

(*Petromyzon plumbeus* Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 28: *Petromyzon ayresi* Günther, viii, 505: *Ammocœtes cibarius* Girard, Pac. R. R. Surv. 383.)

5.—AMMOCŒTES Duméril, 1817.

Brook Lampreys.

(Duméril—Cuvier, Règne Animal : type *Petromyzon branchialis* L. = the larval form of *Petromyzon planeri* Bloch.)

Lampreys of small size, with the dorsal fin continuous, sometimes emarginate, but never divided into two fins, the posterior portion continuous with the low anal fin around the tail; maxillary tooth single, broad, forming a crescentic plate, with a large bluntish cusp at each end, and sometimes a small median cusp; lateral teeth very few; tongue with two broad transverse plates, each with a median cusp; species few; our single species is scarcely distinguishable from the common "Pride" or "Small Lamprey" of Europe, *Ammocœtes branchialis.* (ἄμμος, sand; κοίτη, to lie.)

8. A. niger (Raf.) Jor.—*Small Black Lamprey.*

Head moderate, nearly as long as the "chest"; the mouth comparatively small; lips with a conspicuous fringe of papillæ; dorsal fin high, considerably depressed in front of the vent, but not divided into two fins; the posterior lobe highest; anal fin evident; anal tube conspicuous in the spring; eyes moderate; maxillary tooth with its cusps large, triangular, well separated; a small pointed median cusp usually present in the adult; in younger specimens the median cusp is obsolete, and in half-grown specimens the tooth forms a curved plate without distinct cusps; mandibular plate curved, with *eight* to *ten* well developed subequal tooth-like lobes; inside of it is a plate bearing three teeth; lingual teeth transverse, trifid; a plate on each side of the buccal orifice; the remaining teeth inconspicuous. Bluish black above; silvery below. Size rather small. L. 6 to 10.

A small species ascending Western streams in the spring in great numbers to deposit its spawn. Great Lakes, Ohio Valley, and Upper Mississippi Region. It is perhaps identical with the European *Ammocœtes branchialis.*

(*Petromyzon nigrum* Raf. Ich. Oh. 84; Jordan, 349.)

6.—ICHTHYOMYZON Girard, 1859.

Silvery Lampreys.

(Girard, Pac. R. R. Surv. x, 381: type *Petromyzon argenteus* Kirtland.)

Lampreys of rather small size, having the dorsal fin high and continuous, with only a shallow emargination; the teeth nearly equal over

the large buccal disk, the maxillary teeth being pointed, two in number, set close together, without interspace, and not forming a crescent-shaped plate; lateral teeth all unicuspid; mandibulary with numerous close-set pointed cusps, appearing like distinct teeth; lingual teeth in two series, the posterior series finely pectinate, with a median suture dividing it into a right and left crescent-shaped comb; anterior series not divided; the pectinæ coalescent. This genus is most nearly related to *Petromyzon*, differing chiefly in the continuous dorsal. The two known species inhabit the Mississippi Valley and the Great Lakes. (ἰχθύς, fish; μύζω, to suck.)

* Mandibulary plate with seven teeth.

9. I. argenteus (Kirt.) Grd.—*Silvery Lamprey.*

Body stoutish, compressed behind; head broad, with large buccal disk, which is fringed, but not very conspicuously; teeth pretty strong and nearly uniform, the two maxillary teeth being very similar to those on the rest of the disk; mandibulary teeth connivent, the middle ones the longest; upper margin of dorsal scarcely depressed in front of the vent. Color bluish; sides silvery, often mottled; a small dusky spot above or nearly above each gill-opening, usually conspicuous. L. 12. Great Lakes and Mississippi Valley; rather common; ascending small brooks in the spring.

(*Petromyzon argenteus* Kirtland, Bost. Journ. Nat. Hist. iii, 1840, 342, with plate.—*Ammocœtes concolor* Kirt. l. c. 473, with plate.—*Ichthyomyzon hirudo* Grd. Pac. R. R. Surv. 342.—*Ichthyomyzon hirudo* Gthr. viii, 507.—*Ammocœtes argenteus* et *hirudo* Jordan, 349–'50.—*Ammocœtes æpyptera* Abbott, Proc. Ac. Nat. Sci. Phila. 1860, 327.)

** Mandibulary plate with nine teeth.

10. I. castaneus Grd.—*Chestnut-colored Lamprey.*

Lips with short fringes; dorsal fin high, with a depression in front of the vent. A little known species, differing from the preceding, if at all, in the number of teeth on the mandibulary plate. Minnesota.

(*Ichthyomyzon castaneus* Grd. Pac. R. R. Surv. 381.)

7.—PETROMYZON Linnæus, 1758.

Sea Lampreys.

(Artedi Linnæus, Systema Naturæ; type *Petromyzon marinus* L.)

Lampreys of medium or large size, with the maxillary teeth separate, pointed, and close together, not forming a crescent-shaped plate; mandibulary plate with seven to nine cusps; lingual teeth forming two crescent-shaped plates on each side; first dorsal fin well separated from

the second, which is continuous with the caudal. Species two—marine, ascending rivers. (*πέτρα*, stone; *μύζω*, to suck.)

11. P. marinus L.—*Great Sea Lamprey.*

Head moderate, but little longer than the "chest"; buccal disk large, with numerous conical teeth, arranged in oblique series, those nearest the œsophagus largest and partly bicuspid; two pairs of lunate, pectinate lingual teeth, one in front of the other, the serrations on the anterior pair usually confluent; fins moderate, the dorsals well separated; the second dorsal with a depression on the tail; lips moderately fringed. Color olive-brown, *mottled with blackish confluent patches;* dull brownish below. Size much larger than any of the other species. L. 24 to 36. Atlantic coasts of Europe and North America, chiefly northward, ascending streams in the spring to deposit its spawn.

(*Petromyzon marinus* L. Syst. Nat.; Günther, viii, 501; Jordan, 348.—*Petromyzon americanus* Le Sueur, Trans. Am. Philos. Soc. i, 383.—*Petromyzon americanus* Storer, Fish Mass. 251.)

12. P. nigricans Le Sueur.—*Lamper-eel.*

Head very large, longer than the "chest", $6\frac{1}{2}$ in length; depth about 13; body little compressed; dorsal fins rather low, distinctly separated; eyes and mouth very large; mandibulary plate with 7 to 9 teeth; the rest of the buccal disk covered with rather large teeth disposed in oblique cross-rows, five or more in each row, some of the innermost bicuspid; anterior as well as posterior lingual teeth pectinate; lips fringed. *Coloration nearly plain;* bluish black above, pale below, usually a pale spot between the eyes on the top of the head. L. 12. A rather small species found along the Atlantic coasts of our Northern States, and ascending streams in the spring to spawn, some individuals remaining permanently in fresh water. Abundant in Cayuga Lake, N. Y., from which locality the specimens were taken on which the above description was based.

(*Petromyzon nigricans* Le Sueur, Trans. Amer. Phil. Soc. new series, i, 385; Storer, Fish Mass. 253.—*Ammocœtes fluviatilis* Jordan, 349.)

This species is very different from the European *Lampetra fluviatilis.* It is possibly only a variety of *Petromyzon marinus.* Numerous other Lampreys have been described from our waters, but we find them unrecognizable.

CLASS III.—ELASMOBRANCHII.

(*The Selachians.*)

Skeleton cartilaginous; skull without sutures. Body with median and paired fins; the ventral fins abdominal; shoulder-girdle developed, lyriform; caudal fin heterocercal, the upper lobe produced; gills attached to the skin by the outer margin; gill-openings several, or single leading to several clefts; membrane bones not developed, except sometimes a rudimentary opercle; skin naked or covered with minute imbricated scales or hard plates, sometimes spinous; no air-bladder; arterial bulb with three series of valves; intestine with a spiral valve; optic nerves united by a commissure, not decussating; ovaries with the ova few and large, impregnated, and sometimes developed, internally; embryo with deciduous external gills; males with prehensile intromittent organs, "claspers," attached to the ventral fins. Sharks, Skates, and Chimæras. (ἐλασμὸς, a plate or blade; βράγχία, gills.)

ANALYSIS OF ORDERS OF ELASMOBRANCHS.

* Gill-openings slit-like, 5 to 7 in number; jaws distinct from the skull. (Subclass *Selachii.*)

† Gill-openings lateral.....SQUALI, D.

†† Gill-openings ventral.....RAIÆ, E.

** Gill-openings single, leading to four branchial clefts; jaws coalescent with the skull (subclass *Holocephali*).....HOLOCEPHALI, F.

SUBCLASS SELACHII.

(*The Sharks and Rays.*)

Elasmobranchiates with the gill-openings slit-like, five (rarely six or seven) in number; jaws distinct from the skull; no opercular nor pelvic bones; derivative radii sessile on the sides of the basal bones of the limbs, rarely entering the articulation.

As here understood, this subclass is equivalent to the *Plagiostomata* of authors, and includes the orders or suborders *Raiæ*, the Rays, and *Squali*, the Sharks; groups which are perhaps hardly worthy of ordinal value. (σέλᾶχος, a shark, from σέλᾶχος, cartilage.)

ORDER D.—SQUALI.

(*The Sharks.*)

Gill-openings lateral, slit-like, five to seven in number; general form elongate, the body gradually passing into the tail. The typical sharks

and skates differ much from each other in appearance; but intermediate forms connect the two groups closely. The position of the gill-openings is almost the only constantly diagnostic character. (Suborder *Selachoidei* Günther, viii, 353–433.) (Latin, *squalus*, a shark, from the Greek γαλεός, a shark, which comes from γαλέη, a weasel, or other musteline animal, from resemblances in habits.)

ANALYSIS OF THE FAMILIES OF SQUALI.

* Pectoral fins moderate, without deep notch at the base in front.

† Anal fin absent.

a. Dorsal fins without spine ..... SCYMNIDÆ, 4.

aa. Dorsal fins each preceded by a stout spine (rarely concealed in the skin). SPINACIDÆ, 5.

†† Anal fin present.

b. Dorsal fins two.

c. Dorsal fins both without spine.

d. First dorsal fin behind the ventrals ..... GINGLYMOSTOMATIDÆ, 6.

dd. First dorsal entirely in advance of the ventrals.

e. Caudal fin not lunate, its upper lobe many times longer than the lower, with a notch below toward its tip; tail not keeled.

f. Last gill-opening above the base of the pectoral.

g. Tail moderately developed, forming less than one-third of the total length; eyes with nictitating membranes.

h. Head normally formed ..... GALEORHINIDÆ, 7.

hh. Head hammer-shaped or kidney-shaped by the extension of its sides ..... SPHYRNIDÆ, 8.

gg. Tail exceedingly long, forming about half the total length; eyes without nictitating membranes ..... ALOPIIDÆ, 9.

ff. Last gill-opening entirely in front of the pectoral. CARCHARIIDÆ, 10.

ee. Caudal fin lunate; caudal peduncle with a keel on each side.

i. Last gill-opening entirely in front of ventrals.

j. Gill-openings moderate; teeth well developed. LAMNIDÆ, 11.

jj. Gill-openings very large, nearly meeting under the throat; teeth small ..... CETORHINIDÆ, 12.

ii. Last gill-opening above the base of the pectoral. RHINODONTIDÆ, 13

cc. Dorsal fins each armed with a stout spine ..... HETERODONTIDÆ, 14

bb. Dorsal fin single; the first dorsal obsolete; gill-openings 6 or 7. HEXANCHIDÆ, 15.

** Pectoral fins very large, expanded at the base in front, this expansion separated from the neck by a deep notch; no anal fin. SQUATINIDÆ, 16.

SUPER-FAMILY SCYMNOIDEA.

(*The Scymnoid Sharks.*)

FAMILY IV.—SCYMNIDÆ.

(*The Sleeper Sharks.*)

Sharks with two dorsal fins, *both without spine*, and *no anal fin;* fins all small; gill-openings small, entirely in advance of pectorals; mouth

but little arched; a long, deep, straight, oblique groove on each side of it; spiracles present. (The absence of dorsal spines chiefly distinguishes this family from *Spinacidæ*.)

Genera six; species six or more, mostly of the Atlantic. (Günther, *Spinacidæ*, pt. viii, 425–429.)

* First dorsal opposite ventrals; teeth equal in both jaws, very oblique; skin rough with tubercles and prickles ..... ECHINORHINUS, 8.

** First dorsal much in advance of ventrals; the dorsals about equal; upper teeth narrow; lower quadrate, with a horizontal edge ending in a point directed outwards ..... SOMNIOSUS, 9.

8.—ECHINORHINUS Blainville, 1816.

Spinous Sharks.

(*Goniodus* Agassiz.)

(Blainville, 1816; type *Squalus spinosus* Gmelin.)

Two very small dorsal fins without spine, the first opposite the ventrals; no anal fins; skin with scattered large round tubercles, surmounted by prickles, like those on a bramble, and, like them, leaving a scar when detached. Mouth crescent-shaped, a labial fold around the angle of the mouth; nostrils midway between the mouth and the end of the snout. Teeth equal in both jaws, very oblique, the point being turned outwards; several strong denticulations on each side of the principal point. No nictitating membrane. Spiracles small; gill-openings of moderate width. A single species of the East Atlantic, straying to our coast. (ἐχῖνος, a hedgehog, or sea-urchin; ῥινη, shark.)

13. E. spinosus (Gmel.) Blainv.—*Spinous Shark; Bouclé.*

"Spiracles behind the eye, behind the vertical from the angle of the mouth. Teeth $\frac{22-26}{22-26}$. Dorsal fins close together. Each tubercle with a small spine in the centre. Brownish violet, with or without dark spots" (*Günther*). A large shark of the coasts of Europe and Africa; a stray individual lately taken on Cape Cod.

(*Squalus spinosus* Gmelin Linn. 1, 1500; Günther, viii, 428.)

9.—SOMNIOSUS Le Sueur, 1818.

Sleeper Sharks.

(*Læmargus* Müller & Henle.)

(Le Sueur, Journ. Ac. Nat. Sci. Phila. 1818, i, 222; type, *Somniosus brevipinna* Le Sueur = *Squalus microcephalus* Bloch.)

Body elongate; mouth transverse, little arched, with a deep straight groove running backward from its angle; nostrils near the extremity of the snout; jaws feeble; teeth in upper jaw small, narrow, conical; lower

teeth numerous, in two or more series, the point so much turned aside that the inner margin forms a cutting edge, which is entire; spiracles moderate; no nictitating membrane; gill-openings narrow; fins all very small, the ventrals nearly opposite the second dorsal; skin uniformly covered with minute tubercles. Species few, of the Northern Seas. (Latin, *somniosus*, sleepy.)

14. S. microcephalus (Bloch) Gill.—*Sleeper Shark; Nurse.*

Body robust, rapidly tapering behind; greatest depth about one-fifth the length; head somewhat less; mouth moderate, upper jaw with five rows of small sharp teeth, which are incurved and lancet-shaped; lower jaw with two rows of broad, quadrangular teeth, divided in their centres by a perpendicular ridge and directed outwards, about 26 teeth on each side; spiracles small; skin rough; fins small, the first dorsal about as large as the ventrals and larger than the second dorsal; pectorals short; caudal short and bluntish. L. 8 to 20 feet (*Storer*). Cape Cod to the Arctic Seas.

(*Squalus microcephalus* Bloch, Schn. 135; *Somniosus brevipinna* Le Sueur, Journ. Ac. Nat. Sci. Phila. i, 222; *Scymnus brevipinna* Storer, Fish Mass. 235; *Læmargus borealis* Günther, viii, 426.)

Family V.—SPINACIDÆ.

(*The Dog-fishes.*)

Body more or less elongate; head depressed; eyes lateral, without nictitating membrane; mouth inferior, rather large, arched; teeth compressed, variously formed; nostrils inferior, lateral, near the front margin of the snout; spiracles moderate; gill-openings moderate, *five* on each side, all in front of the pectoral fins; *dorsal fins two, each armed with a spine;* the first dorsal in front of the pectorals; *anal fin wanting;* caudal fin with the lower lobe small or obsolete; ventral fins inserted posteriorly.

Genera six or more; species about fifteen; rather small sharks, chiefly of the Atlantic. (*Spinacidæ*, part, Günther, viii, 417–425.)

* Teeth equal in both jaws; dorsal spines not concealed.

a. Teeth very small, straight, pointed, each with one or two smaller cusps on each side ..... Centroscyllium, 10.

aa. Teeth moderate, simple, subquadrate, each with a nearly horizontal cutting edge, and a point directed outward ..... Squalus, 11.

** Teeth unequal, those in the upper jaw erect, triangular, those in the lower jaw more or less oblique; dorsal spines hidden beneath the skin. Centroscymnus, 12.

10.—CENTROSCYLLIUM Müller & Henle, 1837.

Black Dog-fishes.

(Müller & Henle, Systematische Beschreibung der Plagiostomen, 191; type *Spinax fabricii* Reinhardt.)

Teeth equal in both jaws, very small, straight, pointed, each with one or two smaller cusps on each side at base; mouth crescent-shaped, with a straight, oblique groove at its angle; spiracles moderate; gill-openings rather narrow; dorsal fins small, each with a strong spine; the second dorsal entirely behind the ventrals. One species. (*κέντρον*, spine; *σκύλλιον*, *Scyllium*, an allied genus, from *σκύλλω*, to rend or tear to pieces.)

15.—C. fabricii (Reinhardt) M. & H.—*Black Dog-fish.*

Body covered with minute stellate ossifications; color dark brown. A shark of the Greenland Seas, lately taken off Gloucester, Mass., by the United States Fish Commission.

(*Spinax fabricii* Reinhardt, Dansk. Vid. Selsk. Förh. 1828, iii, xvi; Günther, viii, 425.)

11.—SQUALUS Linnæus, 1758.

Dog-fishes.

(*Acanthias* Risso.)

(Artedi, Linnæus, Systema Naturæ; type *Squalus acanthias* L.)

Body rather slender; mouth little arched, with a long, straight, deep, oblique groove on each side; no labial fold along the margin of the mouth; teeth rather small, equal in both jaws, their points so much turned aside that the inner margin forms the cutting edge; spiracles rather wide, just behind the eye; gill-openings narrow, in front of the pectorals; fins moderately developed, the first dorsal larger than second, much in advance of the ventral fins, which are behind the middle of the body, although in advance of the second dorsal. Small sharks, abounding in the Temperate Seas. (Latin, *squalus*, a shark.)

* Dorsal spine not grooved; its insertion rather behind inner angle of the pectorals.

16.—S. acanthias L.—*Picked Dog-fish; Dog-fish; Bone Dog; Skittle-dog; Hoe.*

Body slender; snout pointed; head 6½ in length; depth about 8; slate-color above, pale below, back with whitish spots, especially in the young. L. 1 to 3 feet; weight 5 to 15 pounds.

A small sharp-toothed shark, ranging widely in the Atlantic, very abundant along the shores of the Northern and Middle States. It is somewhat valued for its livers, from which "Dog-fish" oil is extracted. American writers have usually considered our species (*Squalus ameri-*

canus (Storer) Gill) as distinct from the European, but no reliable distinctions have been pointed out.

(*Squalus acanthias* L. Syst. Nat.; *Acanthias americanus* Storer, Synopsis, 506; *Acanthias americanus* Storer, Fish Mass. 232; *Acanthias vulgaris* Günther, viii, 418. *Squalus sucklii* (Grd.) Gill, from the Pacific coast of the United States, is considered by Dr. Günther and others as the same species; *Spinax* (*Acanthias*) *sucklii* Girard, Proc. Ac. Nat. Sci. Phila. 1854, 176; *Squalus sucklii* Gill, Proc. Ac. Nat. Sci. Phila. 1862, 499.)

12.—CENTROSCYMNUS Bocage & Capello, 1864.

(Bocage & Capello, Proc. Zool. Soc. 1864, 263; type *Centroscymnus cœlolepis* Boc. & Cap.)

Dorsal fins each with a *spine*, which is *hidden below the skin;* mouth wide, but little arched; a long, deep, straight, oblique groove on each side of the mouth. Teeth of the lower jaw oblique, with the point more or less directed outwards. Upper teeth lanceolate, on a quadrangular base, with a single cusp. Spiracles wide, behind the eye. Gill-openings narrow. (κέντρον, spine; σκύμνος, an ancient name of some shark, from σκύμνος, a lion's whelp.)

17. C. cœlolepis Bocage & Capello.

Labial groove prolonged forwards, but separated by a broad space from that of the other side. Upper teeth very small, narrow and lanceolate. The distance between the nostrils is rather less than $\frac{1}{2}$ the length of the præoral portion of the snout. Lower angle of the pectoral rounded, not produced. Dorsal fins short, especially the first, the length of which (without the spine) is only about $\frac{1}{6}$ its distance from the second. Extremity of the ventrals below the end of the second dorsal. Scales on the head and nape with striæ, the others smooth, with a depression at the base. Uniform blackish brown. (*Günther.*) Coast of Portugal and neighboring parts of the Atlantic, a specimen taken near Gloucester, Mass.

(Bocage & Capello, Proc. Zool. Soc. 1864, 263; *Centrophorus cœlolepis* Günther, viii, 423.)

SUPER-FAMILY SCYLLIOIDEA.

(*The Scyllioid Sharks.*)

FAMILY VI.—GINGLYMOSTOMATIDÆ.

(*The Nurse Sharks.*)

Sharks with the first dorsal *above or behind the ventrals;* no spines; anal fin present; caudal fin bent upwards, with a basal lobe; mouth inferior, with small teeth, in several series; nostril confluent with the mouth; nasal valves of both sides forming a quadrangular flap in front

of the mouth, each being provided with a free cylindrical cirrus; an upper and lower lip, the latter not extending across the symphysis; fourth and fifth gill-openings close together; eyes very small. The backward position of the first dorsal distinguishes this family from all others in our waters. Genera two; species about four; large sharks of the warm seas. (*Scylliidæ* pt. Günther, viii, 407–409.)

* Teeth in both jaws in many series, each with a strong median cusp, and one or two smaller cusps on each side..... .....GINGLYMOSTOMA, 13.

13.—GINGLYMOSTOMA Müller & Henle, 1837.

(Müller & Henle, Wiegmann's Arch. 1837, p. —: type *Squalus cirratus* Gmelin.)

The characters of this genus are those of the family above given, with the addition of the following, which distinguish *Ginglymostoma* from *Nebrius:* teeth of both jaws in many series, each with a strong median cusp, and one or two smaller cusps on each side. (γίγγλῦμος, a hinge or hinge-like joint; στόμα, mouth.)

18. G. cirratum (Gmel.) M. & H.—*Nurse Shark.*

Uniform brownish; young specimens with small, scattered, round black spots; nasal cirrus reaching the lower lip; angles of the fins obtusely rounded; caudal fin forming nearly one-third of the total length. L. 6 to 10 feet. (*Günther.*)

A large shark of the warmer parts of the Atlantic, abundant in the Gulf of Mexico and the West Indies, and occasionally taken on our South Atlantic coast.

(*Squalus cirratus* Gmelin's Linnæus, i, 1492; Müller & Henle, 23; Günther, viii, 408.)

SUPER-FAMILY GALEORHINOIDEA.

(*The Galeorhinoid Sharks.*)

FAMILY VII.—GALEORHINIDÆ.

(*The True Sharks.*)

Sharks with two dorsals and an anal fin; no spines; pectorals moderate; caudal fin not greatly elongated, not lunate, moderately bent upwards, notched toward its end, and with the basal much less developed than the upper; caudal peduncle not keeled; posterior gill-opening above the base of the pectoral fin; eyes with nictitating membranes; head not hammer-shaped, the snout being longitudinally produced as usual among sharks. A large family of twenty or more genera and about

sixty species; found in all seas. (*Carchariidæ* part (*Carchariina* and *Mustelina*) Günther, viii, 357–380, and 383–388.)

* Teeth flat and paved, without cusps or cutting edges; spiracles present. (*Mustelinæ.*)
a. No pit at the root of the tail; labial folds well developed.....MUSTELUS 14.
** Teeth more or less compressed, with entire or serrate sharp edges. (*Galeorhininæ.*)
b. Spiracles present.
c. No pit at the root of the tail.
d. Teeth small, each with a median cusp and one or two small lateral cusps on each side.....TRIACIS, 15.
dd. Teeth larger, with a single cusp, oblique, notched and serrated, GALEORHINUS, 16.
cc. A pit at the root of the tail; teeth all serrate; caudal fin with a double notch.....GALEOCERDO, 17.
bb. Spiracles obsolete.
e. Teeth serrate, more or less (entire in the very young or very old); little oblique or nearly upright.
f. Teeth well serrated (in the adult); those of the upper jaw comparatively broad or triangular; those of the lower narrow and claviform, CARCHARINUS, 18.
ff. Teeth scarcely serrated, constricted at base, narrow, claviform, and straight in both jaws.....ISOGOMPHODON, 19.
ee. Teeth all entire.
g. Teeth nearly upright, the points not much directed towards the sides.....APRIONODON, 20.
gg. Teeth oblique and flat, the points turned to the right or left away from the centre, so that the inner margins are nearly horizontal and present a cutting edge.....SCOLIODON, 21.

14.—MUSTELUS Cuvier, 1817.

(*Hound Sharks.*)

(Bellon, Cuvier, Règne Animal: type *Mustelus vulgaris* M. & H.)

Body elongate, slender, not elevated; snout comparatively long and flattened; mouth crescent-shaped, with well-developed labial folds; teeth small, many-rowed, flat and smooth, rhombic, arranged like pavement, alike in both jaws; eyes large, oblong; spiracles small, just behind the eyes; pectoral fins large; first dorsal large, not much behind pectorals; second dorsal somewhat smaller; anal opposite second dorsal and still smaller; ventrals well developed; basal lobe of caudal almost obsolete; embryo not attached to uterus by a placenta. Small sharks, the smallest of the American species, known at once by the smooth, paved teeth. (Latin, *mustela*, a weasel or martin; the use of the word similar to that of γαλέη, γαλεὸς.)

19. M. hinnulus (Blainv.) J. & G.—*Smooth Hound; Dog Shark.*—Emissole.

Body slender, tapering backward from the dorsal fin to the long slender tail; snout depressed, moderately sharp; mouth small, the teeth all alike, a fold at the angle of the mouth; first dorsal rather large,

prolonged behind, nearly midway between the pectorals and ventrals; second dorsal smaller, but larger than usual in sharks; anal slightly behind second dorsal, and much smaller; pectoral fins broad and large, reaching past front of dorsal; back slightly keeled. Smallest of our sharks; abundant on the Atlantic coasts of both continents, especially northward. Specimens from Cape Cod and from Venice apparently differ in no important respect.

(*Galeorhinus hinnulus* Blainville Faune Franc. 1828, 83; *Mustelus vulgaris* Günther viii, 386; *Mustelus canis* Storer, Fish Mass. 227.)

20. M. californicus Gill.

First dorsal beginning over terminal third of pectoral; its acute point not reaching to insertion of ventrals; anterior angle of dorsal blunt; second dorsal similar to first, but smaller; snout rather more pointed than in most of the species. D. 18 + 17; A. 18; P. 22. Coast of California. (*Gill.*) Scarcely different from the preceding.

(Gill, Proc. Ac. Nat. Sci. Phila. 1864, 148.)

15.—TRIACIS Müller & Henle, 1838.

(*Rhinotriacis* Gill.)

(*Triakis* Müller & Henle, Magazine of Natural History, vol. ii: type *Triakis scyllium* Müller & Henle.)

Body compressed, elongate; mouth large, crescent-shaped, with well-developed long labial folds; teeth small, numerous, similar in both jaws, each with a longer median cusp, and one or two smaller ones on each side; eyes small, with nictitating membrane; spiracles small, behind the eyes; no pit at the root of the caudal; no lower lobe to the caudal; first dorsal fin opposite the space between the pectorals and ventrals. Pacific and Indian Oceans. (τρεῖς, three; ἀκίς, point.)

21. T. semifasciatus Girard.—*Dog Shark.*

"Snout moderately produced, rounded. Nostril with a broad anterior flap. The first dorsal fin is nearly midway between the pectorals and ventrals, the second is not much smaller than the first, and nearly in advance of the anal. Upper parts with well defined black cross bands, narrower than the interspaces. A row of rounded black spots along the sides of the body, alternating with the interdorsal cross bars. Coasts of California." (*Günther.*)

(Girard, Proc. Ac. Nat. Sci. Phila. 1854, 196; Günther, viii, 384.—*Mustelus felis* Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 18.)

22. T. henlei (Gill) Putnam.

Color uniform reddish brown above, pale below, the pectoral, ventral, and anal fins margined with paler; snout produced, slender; otherwise

essentially as in the preceeding (*Gill*). California. A single young specimen known.

(*Rhinotriacis henlei* Gill, Proc. Ac. Nat. Sci. Phila. 1862, 486.)

16.—GALEORHINUS Blainville, 1816.

Topes.

(*Galeus* Cuvier, 1817.)

(Blainville, 1816: type *Squalus galeus* L.)

First dorsal opposite the space between the pectorals and ventrals; mouth crescent-shaped, with the teeth alike in both jaws, oblique, notched, and serrated; spiracles present, small; nictitating membrane present; no pit at the base of the caudal fin; caudal fin with a single notch. Tropical seas. (*γαλέος*, a kind of shark colored like a weasel; *ῥινη*, shark.)

23. G. galeus (L.) Blainv.—*Tope.*

A short labial fold on both jaws; teeth $\frac{3\,4}{3\,4}$. Second dorsal fin only one-third the size of the first and somewhat in advance of the anal. Length of tail nearly equal to distance between dorsals. (*Günther.*) Europe to the Indian Ocean. "San Francisco." (*Günther.*)

(*Squalus galeus* L. Syst. Nat.; *Galeus canis* Günther, viii, 379.)

17.—GALEOCERDO Müller & Henle, 1837.

Tiger Sharks.

(Müller & Henle, Wiegmann's Archiv, 1837: type *Galeocerdo tigrinus* Müller & Henle.)

Mouth crescent-shaped; teeth nearly equal in both jaws, oblique, serrated on both margins, with a deep notch on outer margin; spiracles present; caudal fin with a double notch; a pit on the tail above and below at the base of the caudal fin; first dorsal opposite the space between pectorals and ventrals. Large sharks, found in most seas. (*γαλεός*, a kind of shark, marked like *γαλέη*, the weasel; *κερδώ*, a fox or weasel; *κέρδος*, craft.)

24. G. tigrinus Müller & Henle.—*Tiger Shark.*

Color brown, with numerous dark spots larger than the eye; caudal fin forming about one third of the total length, much longer than the space between the dorsal fins; second dorsal somewhat in advance of the anal; a long labial fold along the upper jaw. (*Günther.*) Cape Cod to Indian Ocean; a rather large shark, known by its variegated coloration.

(Müller & Henle, 59; Günther, 378.)

18.—CARCHARINUS Blainville, 1816.

Blue Sharks.

(*Cynocephalus* Klein, Gill.)
(*Carcharias* Cuvier, not of Rafinesque.)
(*Prionodon* Müller & Henle.)
(*Eulamia* Gill.)

(Blainville 1816 : type *Carcharinus commersoni* Blainville.)

Large sharks, without spiracles, with the teeth in both jaws strongly serrated in the adult, those in the upper jaw broad, those below narrower, straight, and claviform; first dorsal large; second dorsal much smaller, usually not larger than the anal. Species numerous in the tropical seas. (*χάρχαρος*, rough; *δινη*, shark; abbreviated from *Carcharorhinus.*)

* Body and head slender; dorsal fin inserted midway between pectorals and ventrals (*Carcharinus*).

25. C. glaucus (L.) Jor. & Gilb.—*Great Blue Shark.*

"Snout very long, nostrils rather nearer to the mouth than to the extremity of the snout; no labial fold except a groove at the angle of the mouth; teeth of the upper jaw oblique, scarcely constricted near the base; lower teeth slender, triangular in young examples, lanceolate, with a broad base, in old ones. Pectoral fin long, falciform, extending to the dorsal, which is nearer the ventrals than the root of the pectorals." (*Günther.*) A large shark of the warm seas, occasionally taken on our coast.

(*Squalus glaucus* L. Syst. Nat.; *Carcharias glaucus* Gunther, viii, 364.)

** Body and head stout; dorsal fin placed close behind the root of the pectorals (*Eulamia* Gill).

26. C. obscurus (Le Sueur) J. & G.—*Dusky Shark.*

Dark clear blue above, white below; head rather pointed, flattened above and below; first dorsal rather large; second smaller than the anal, and considerably produced behind; pectorals large, falciform. A large shark, reaching a length of nine or ten feet, inhabiting the North Atlantic and frequently taken on our coast.

(*Squalus obscurus* Le Sueur, Journ. Ac. Nat. Sci. Phila. 1818, i, 223; *Carcharias obscurus* Günther, viii, 366.)

27. C. milberti (Müller & Henle) Jor. & Gilb.—*Blue Shark.*

This species is represented as having the snout shorter, blunter, and

higher than in the preceding, and with the pectoral fins considerably shorter and broader, not reaching half way to the ventrals.

Cape Cod to the Mediterranean Sea.

(*Carcharias* (*Prionodon*) *milberti* M. & H. 38; Gill, Proc. Ac. Nat. Sci. 1864, 262.—*Carcharias cæruleus* DeKay, 349; *Lamna caudata* DeKay, 354.)

27. *b.* **C. lamia** (Risso) Jor. & Gilb.

This species was provisionally identified by Prof. Putnam from a tooth obtained on St. Peter's Bank belonging to a fish estimated to have been at least thirteen feet in length. (*Goode and Bean.*) In this species the upper teeth are little oblique, serrated, broad, and regularly triangular; dorsal large; the second dorsal smaller than the anal; teeth $\frac{27—31}{27—30}$. (*Günther.*)

(*Carcharias lamia* Günther viii, 372; *Prionodon lamia* Goode & Bean, Bull. Essex Inst., 1879, 30.)

19.—ISOGOMPHODON Gill, 1861.

Sharp-nosed Sharks.

(Gill, Ann. Lyc. Nat. Hist. N. Y. vii, p. 410: type *Carcharias* (*Prionodon*) *oxyrhynchus* Müller & Henle.)

This genus differs from *Eulamia* principally in the dentition; the teeth are similar in form in both jaws, constricted at the base, claviform and straight, their edges scarcely serrated; the snout is slender and rather conic and pointed. Large sharks, of the tropical seas. (ἴσος, equal; γόμφος, a nail, or peg; ὀδών, tooth.)

28. I. limbatus (Müller & Henle) Gill.—*Spotted-fin Shark.*

"Snout somewhat pointed in front, rather produced, the distance between its extremity and the mouth being somewhat less than the width of the mouth; nostrils nearly midway between the extremity of the snout and the mouth; teeth $\frac{25—29}{27—30}$, similar in form in both jaws, namely, erect, constricted, on a broad base, the upper more distinctly serrated than the lower; gill-openings wide, at least twice as wide as the eye, which is small; pectorals falciform, extending beyond the end of the dorsal, the length of their upper margin being nearly four times that of the lower. First dorsal commencing very close behind the axil of the pectoral; origins of the second dorsal and anal opposite to each other, the bases of both being nearly equally long. Caudal fin long, with the upper edge slightly undulated, its length being equal to the distance between the origins of the two dorsal fins. The lower side of the extremity of the pectoral, and the extremities of the second dorsal and

anal, and of the lower caudal lobe black". (*Günther.*) Tropical seas; a stray specimen taken at Wood's Hole, Mass.

(*Carcharias* (*Prinodon*) *limbatus* M. & H., 49; *Carcharias limbatus* Günther, viii, 373.)

20.—APRIONODON Gill, 1861.

Smooth-toothed Sharks.

(*Aprion* Müller & Henle, preoccupied.)

(Gill, Ann. Lyc. Nat. Hist. N. Y. vii, 411: type *Squalus punctatus* Mitch.)

Snout more or less produced and conic; teeth entire, without serræ or basal cusps, all of them narrowed on a broad base, the lower erect, the upper erect or only slightly oblique; dorsal more or less posterior, opposite the space between pectorals and ventrals. (α, privative; πρίων, saw; ὀδών, tooth; the edges of the teeth being always entire.)

29. A. punctatus (Mitch.) Gill.—*Smooth-toothed Shark.*

"Distance of the extremity of the snout from the mouth equals that between the nostrils. Pectoral fin subfalciform, extending to the end of the dorsal. Second dorsal much smaller than the first." (*Günther.*) Atlantic; probably not common on our coast.

(*Squalus punctatus* Mit. Lit. & Phil. Trans. N. Y. i, 483: *Carcharias isodon* M. & H. 32: *Carcharias punctatus* Günther, viii, 361.)

21.—SCOLIODON Müller & Henle, 1837.

Oblique-toothed Sharks.

(Müller & Henle, Wiegmann's Archiv f. Naturg. iii: type *Scoliodon laticaudus* M. & H.)

Sharks with the teeth entire, oblique and flat, the points directed toward the sides of the mouth, so that the inner margins are nearly horizontal, and present a smooth cutting edge, those in front more nearly erect; teeth not swollen at the base; each of them with a deep notch on the outer margin below the sharp point; no spiracles; a pit at base of tail; first dorsal well in front of ventrals, much larger than second. (σκολιός, twisted or crooked; ὀδών, tooth.)

30. S. terræ-novæ (Richardson) Gill.—*Sharp-nosed Shark.*

Body slender; snout depressed, moderately rounded; mouth U-shaped, with a short labial groove at its angle, which groove extends on the upper jaw as well as on the lower; distance between nostrils greater than distance from nostrils to end of snout; gill-openings narrow; first dorsal moderate, midway between pectorals and ventrals; second dorsal very small, slightly behind, and rather smaller than the anal; anal fin much shorter than distance from anal to ventrals; a slight furrow along

the middle line of the back, ending in a pit at the root of the tail; pectoral fins rather large; ventrals small. Color gray; caudal fin with a conspicuous narrow blackish edge. Newfoundland to South America; common southward. Size rather small.

(*Squalus* (*Carcharias*) *terræ-novæ* Richardson, F. B. A. iii, 289: *Carcharias terræ-novæ* Günther, viii, 360.)

Family VIII.—SPHYRNIDÆ.

(*The Hammer-headed Sharks.*)

General characters of the *Galeorhinidæ*, but the head singularly formed, kidney-shaped or "hammer"-shaped from the extension of its sides, the nostrils being anterior and the eyes on the sides of the "hammer"; mouth crescent-shaped, under the "hammer"; the teeth of both jaws similar, oblique, each with a notch on the outside near the base; no spiracles; last gill-opening over the pectorals; first dorsal and pectorals large, the dorsal nearer pectorals than ventrals; second dorsal and anal small; a pit at the root of the caudal; caudal fin with a single notch toward its tip, its lower lobe developed. Genera 3; species 5; inhabiting most seas. Large sharks, known at once by the singular form of the head. (*Carchariidæ*, part: group *Zygænina* Günther, 380–383.)

* Nostrils near the eyes.

a. Nostrils simple, with the frontal grooves rudimentary or obsolete; head reniform, its anterior and lateral margins confluent, forming a semicircle.
Reniceps, 22.

aa. Nostrils with grooves extending in front toward the middle of the head; head truly hammer-shaped ..... Sphyrna, 23.

22.—RENICEPS Gill, 1861.

Bonnet-headed Sharks.

(Gill, Ann. Lyc. Nat. Hist. N Y. 1861, viii, p. 412: type *Squalus tiburo* L.)

Head reniform, the anterior and lateral margins confluent, forming a regular semicircle, the posterior margins of the sides of the hammer very short; nostrils close to the eyes, with the grooves indistinct. (Latin, *rena*, kidney; *ceps*, head.)

31. R. tiburo (L.) Gill.—*Shovel-head Shark; Bonnet Head.*

Body rather slender, not much compressed; head depressed, semicircular in front, reniform, the posterior free margins short, the lateral margins continuous with the anterior; pectorals large; first dorsal high, midway between pectorals and ventrals; second dorsal much smaller, produced behind, higher and shorter than anal; ventral fins moderate; caudal moderate; mouth small, crescentic; teeth small, very oblique, with a deep notch on the outer margin. Color uniform ashy, paler

beneath; head $4\frac{1}{3}$ in length, 6 to tip of caudal; width of head slightly less than length of head. L. 3 to 6 feet or more. Atlantic Ocean; abundant southward; ranging to China.

(*Squalus tiburo* L. Syst. Naturæ: *Zygæna tiburo* Günther, viii, 382.)

23.—SPHYRNA Rafinesque, 1810.

Hammer-head Sharks.

(*Cestracion* (Klein) Gill; *Zygæna* Cuvier; preoccupied.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi, etc.: type *Squalus zygæna* L.)

Head truly "hammer"-shaped, the anterior, lateral, and posterior margins distinct; nostrils near the eyes, the openings confluent with a groove, which extends along most of the front margin of the head. Species few, reaching a large size; found in all warm seas. (*σφύρα*, a hammer.)

32. S. zygæna (L.) M. & H.—*Hammer-headed Shark.*

Width of head about twice its length; first dorsal large; second quite small, smaller than anal; pectorals rather large; color gray. A large shark, found in all warm seas; common on our coast from Cape Cod southward.

(*Squalus zygæna* L. Syst. Naturæ: *Zygæna malleus* Günther, viii, 381: *Zygæna malleus* Storer, Fish Mass. 238.)

Super-family LAMNOIDEA.

(*The Lamnoid Sharks.*)

Family IX.—ALOPIIDÆ.

(*The Thresher Sharks.*)

Body moderately elongate; the snout rather short; mouth crescent-shaped; teeth equal in both jaws, moderate sized, flat, triangular, not serrated; the third tooth of the upper jaw on each side much smaller than the others; gill-openings moderate, the last one above the root of the pectorals; *no nictitating membrane;* spiracles just behind eye, minute or absent; first dorsal large, midway between pectorals and ventrals; second dorsal and anal very small; caudal fin exceedingly long, about as long as the rest of the body, a pit at its root, a notch on the upper lobe near its tip; lower lobe moderately developed; no caudal keel; ventrals rather large; pectorals very large, falcate. A single species, reaching a large size, inhabiting most seas; known at once by the great length of the caudal fin. (*Lamnidæ*, part, Günther, viii, p. 393; genus *Alopecias*.)

24.—ALOPIAS Rafinesque, 1810.

Thresher Sharks.

(*Alopecias* Müller & Henle; corrected orthography.)

(Rafinesque, Caratteri di Alcuni N. Generi, etc.: type *Alopias macrourus* Raf. =*Squalus vulpes* Gmelin.)

The characters of the genus are included above. (ἀλωπός, a fox; Latin, *vulpes*. *A. vulpes* was known to the ancients as ἀλωπεκίας = fox-like.)

33. A. vulpes (Gmel.) Bonap.—*Thresher; Fox-Shark; Swingle-tail; Long-tail Shark.*

A large shark, abounding in all warm seas, especially in the Mediterranean and Atlantic. It is also occasionally taken on our Pacific coast. Known at once by the great length of the tail.

(*Squalus vulpes* Gmelin, Linn. Syst. Nat. i, p. 496; *Alopecias vulpes* Günther, viii, 393.)

Family X.—CARCHARIIDÆ.

(*The Sand Sharks.*)

Body rather elongate, the snout sharp; mouth crescent-shaped, wide; the teeth large, long, and narrow, subulate, most of them with one or two small cusps at the base, their edges entire; gill-openings rather large, *all of them in front of the pectorals;* two dorsals, moderate, subequal, the anal similar; fins, dorsal well behind pectorals; caudal well developed, with a short basal lobe and a notch toward its tip; no caudal keel; pectorals rather short; no nictitating membrane; spiracles minute, pore-like. Genera 1 or 2, *Carcharias* Raf. (=*Odontaspis* Ag.; not *Carcharias* Cuv.=*Carcharinus*) and "*Eugomphodus*"; species 3. Voracious sharks of moderate size, chiefly inhabiting the Atlantic. (*Lamnidæ*, part, Günther, viii, 392; genus *Odontaspis*.)

* Teeth large, awl-shaped, all or nearly all of them with one or two small cusps at the base ..... CARCHARIAS, 25.

25.—CARCHARIAS Rafinesque, 1810.

Sand Sharks.

(*Odontaspis* Agassiz.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi, etc.: type, and *only species mentioned*, *Carcharias taurus* Raf.)

Characters of the genus included above. (*χάρχαρος*, rough.)

* First and fourth teeth of the upper jaw and first tooth of the lower simple, without basal cusps. (*Eugomphodus* Gill.)

34. C. americanus (Mitch.) Jor. & Gilb.—*Sand Shark; Shovel-nose.*

Body elongate, its depth one fifth the length; head rather pointed, about one seventh of the length; fins small, the first dorsal not much

larger than the second, both similar to the anal; pectoral fins short, obtuse, or truncate; color gray. L. 4 to 6 feet.

A small voracious shark with very sharp teeth, rather common on our Atlantic coast.

(*Squalus americanus* Mitch. Trans. Lit. & Phil. Soc. 1814, i, 483: *Squalus littoralis* Mitch. Am. Monthly Mag. ii, 1818, 328: *Carcharias griseus* Storer, Fishes Mass. 217: *Odontaspis americanus* Günther, viii, 392: *Eugomphodus littoralis* Gill, Proc. Ac. Nat. Sci. Phila. 1864, 260.)

Family XI.—LAMNIDÆ.

(*The Porbeagles.*)

Sharks of large size, with the body stout, the mouth wide, with large teeth, and the caudal fin lunate, the two lobes being not very unequal, the upper lobe strongly bent upward; caudal peduncle with a keel on each side; gill-openings wide, all in front of the pectorals, entirely lateral, not extending under the throat; first dorsal large; pectorals large; ventrals moderate; second dorsal and anal very small; a pit at the root of the caudal; spiracles minute or absent. Genera 3; species 6 or more. Those inhabiting our coasts have been much confused by authors. (*Lamnidæ*, part, Günther, viii, 389–392.)

* Teeth with entire edges.

a. Teeth without basal cusps, long, flexuous, prismatic, and acute...ISURUS, 26.

aa. Teeth, or most of them, with a small cusp on each side at base, compressed, sharp, and somewhat triangular .....LAMNA, 27.

** Teeth with serrated edges, compressed, and triangular in form..CARCHARODON, 28.

26.—ISURUS Rafinesque, 1810.

Porbeagles.

(*Oxyrhina* Ag.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi: type *Isurus oxyrhynchus* Raf.=*Oxyrhina spallanzanii* Bon.)

Snout rather long and pointed; first dorsal and pectorals large; second dorsal and anal very small; caudal peduncle slender; teeth long, lanceolate, with sharp entire cutting edges and no basal cusps. (ἴσος, equal; οὐρά, tail; the two lobes of the tail being nearly equal, as in all the members of this family.)

* First dorsal inserted entirely behind pectorals, nearly midway between pectorals and ventrals. (*Isuropsis* Gill.)

35. I. glaucus (M. & H.) Jor. & Gilb.—*Mackerel Shark.*

This species, if really occurring on our coast, will be known from the other *Isuri* by the position of the dorsal, which is distinctly behind the

pectorals, nearly midway between them and the ventrals. This position is represented in DeKay's figure (Nat. Hist. N. Y. Fishes, pl. 63, fig. 206). Atlantic Ocean; Cuba (*Poey*).

(*Oxyrhina glauca* Müller & Henle, 69: *Lamna punctata* DeKay (not of Mitchill), 352: *Isuropsis dekayi* Gill, Ann. Lyc. N. Y. viii, 153: *Lamna glauca* Günther, viii, 391.)

** Dorsal fin inserted close behind the root of the pectorals, much nearer pectorals than ventrals. (*Isurus.*)

36. I. oxyrhynchus Raf.—*Sharp-nosed Shark; Mackerel Shark.*

"Præoral portion of the snout as long as the longitudinal axis of the cleft of the mouth, tetrahedral, pointed. Angle of the mouth midway between the gill-opening and nostril. Teeth $\frac{13}{11}$ on each side; long, lanceolate, with sharp lateral edges, without basal cusps. The third tooth on each side of the upper jaw is much smaller than those next to it. Gill-openings extremely wide, the width of the first being rather more than its distance from the last. Origin of the dorsal fin at a very short distance from the base of the pectorals, which are falciform, the length of their lower margin being one-fourth of that of the upper." (*Günther.*)

(Storer's figure of "*Lamna punctata*" (Fish. Mass. pl. 37, f. 1) represents, so far as the position of the dorsal is concerned, the present European species, instead of the preceding. No mention is made of the presence of lateral cusps on the teeth. The occurrence of a true *Isurus* on our coast does not seem, however, to have been verified, although it is not improbable.)

(*Lamna punctata* Storer, Fish. Mass. 225: *Lamna spallanzanii* Günther, viii, 390: *Isurus oxyrhynchus* Raf. Caratteri, etc.)

27.—LAMNA Cuvier, 1817.

Porbeagles.

(Cuvier, Règne Animal, ii: type *Squalus cornubicus* Gmelin.)

Body short and stout, the back considerably elevated; snout prominent, pointed; teeth triangular, pointed, entire, each one with a small cusp on each side at base; (one or both of these sometimes obsolete in the young on some of the teeth;) gill-openings wide; dorsal and pectoral fins somewhat falcate; second dorsal and anal fins very small, nearly opposite each other; first dorsal close behind the root of the pectorals. (λάμνα, a kind of shark, from λάμιᾰ, a horrible anthropophagous monster, into which a daughter of Belus was changed by Juno, because she was beloved by Jupiter; a bugbear used by the Greeks to frighten refractory children.)

37. L. cornubica (Gmel.) Fleming.—*Beaumaris Shark; Porbeagle; Tope.*

Snout conical, pointed, rather longer than the cleft of the mouth; teeth $\frac{12}{11}$ or $\frac{11}{10}$ on each side ($\frac{13}{12}$ or $\frac{16}{14}$ in European specimens, *fide* Günther); the third tooth on each side in the upper jaw small; first dorsal beginning over the axil of the pectorals; color gray. A large and fierce shark of the North Atlantic, not till lately recorded from our coast. (A specimen in the Museum of Butler University, from which the above account was taken, was obtained by Dr. T. H. Bean at Wood's Hole, Mass.)

(*Squalus cornubicus* Gmelin, L. i, 1497; Günther, viii, 389.)

28.—CARCHARODON Smith, 18—.

Great White Sharks.

(Sir Andrew Smith, Proc. Geol. Soc. London, —: type *Carcharodon capensis* Smith = *C. rondeleti*.)

This genus differs from *Isurus* chiefly in the dentition, the teeth being large, flat, erect, regularly triangular, their edges serrated; first dorsal moderate, nearly midway between pectorals and ventrals; second dorsal and anal very small; pectoral large, ventrals moderate; caudal peduncle rather stout; spiracles minute or absent. Sharks of very large size; found in most seas. (*χάρχαρος*, rough; *ὀδών*, tooth.)

38. C. rondeleti Müller & Henle.—*Man-eater Shark; Atwood's Shark.*

Body stout, depth about $5\frac{1}{2}$ in total length; mouth very large; both jaws with five rows of large, triangular, serrated teeth, those in the lower jaw narrower, about $\frac{24}{22}$ in each row; first dorsal somewhat behind pectorals; caudal fin large and strong. Color leaden gray; tips and edges of pectorals black (*Storer*). One of the largest of the sharks, reaching a length of fifteen feet and the weight of nearly a ton. It is found in all temperate and tropical seas, but is rare on our coasts. American specimens have been named *C. atwoodi*, but are probably not distinct from the European.

(Müller & Henle, Plagiostomes, 70; Günther, viii, 392: *Carcharias atwoodi* Storer, Fishes Mass. 222.)

Family XII.—CETORHINIDÆ.

(*The Basking Sharks.*)

Sharks of immense size, with the gill openings extremely wide, extending from the back nearly to the median line of the throat; all of them in front of the pectorals; mouth moderate, the teeth very small,

numerous, conical, without cusps or serratures; no nictitating membrane; spiracles very small, above the corners of the mouth; first dorsal large, midway between pectorals and ventrals; second dorsal and anal small; caudal fin lunate, the upper lobe considerably the larger; caudal peduncle keeled; pectorals and ventrals large. A single genus, with probably but one species; the largest of living sharks; inhabiting the northern seas. (*Lamnidæ*, part, Günther, viii, 394; genus *Selache*.)

29.—CETORHINUS Blainville, 1810.

Basking Sharks.

(*Selache* Cuvier.)

(Blainville, Bull. Soc. Philom. 1810, p. 169: type *Cetorhinus gunneri* Blainv. = *Squalus maximus* L.)

The characters of the genus are included above. (κῆτος, whale; ῥίνη, a shark (*Squatina*), from ῥίνη, a file or rasp, the rough skin of the shark being used for polishing wood and marble.)

39. C. maximus (L.) Blainville.—*Basking Shark.*

Body rugose, the skin very rough, with small spines; head small; snout blunt; eyes small; teeth in six or seven rows in each jaw, about 200 in each row; first dorsal large, triangular, over the space between pectorals and ventrals; second dorsal much smaller, rather larger than anal; tail large. Largest of the sharks, reaching a length of nearly forty feet; found in the Arctic seas; straying southward to Portugal and Virginia.

(*Squalus maximus* L. Syst. Nat.: *Selachus maximus* Storer, Fish. Mass. 229: *Selache maxima* Günther, viii, 394.)

Family XIII.—RHINODONTIDÆ.

(*The Whale Sharks.*)

Origin of the first dorsal fin somewhat in advance of the ventrals; the second small, opposite to the anal; both without spines; a pit at the root of the caudal, with the lower lobe of the caudal well developed; sides of the tail with a keel; no nictitating membrane; spiracles very small; mouth and nostril near the extremity of the snout; teeth very small and numerous, conical; gill-openings wide, the last one above the base of the pectorals. Large sharks, of warm seas. Two species are known, *Rhizodon typicus* from the Cape of Good Hope, and the following. (*Rhinodontidæ* Günther, viii, 396.)

* Teeth each recurved backward and acutely pointed, swollen, and with a heel-like projection in front rising from its base ..... MICRISTODUS, 30.

30.—MICRISTODUS Gill, 1865.

(Gill, Proc. Ac. Nat. Sci. Phila. 1865, 177: type *Micristodus punctatus* Gill.)

This genus is known from its teeth only. These are described as follows: "The teeth are fixed and extremely minute, the largest little more than a *line* in length (in a shark 20 feet long) and decrease towards the ends of the jaw; they are disposed in regularly transverse rows, of which there are 164 to 167 on each side, while in front there are 13 to 16 in each transverse row; each tooth is recurved backwards and acutely pointed, swollen and with a heel-like projection in front rising from its base."—(*Gill.*) (μικρὸς, small; ἱστός, an upright projection; ὀδοὺς, tooth.)

40. M. punctatus Gill.

A very large spotted shark found in the Gulf of California. (Gill, Proc. Ac. Nat. Sci. Phila. 1865, 177.)

Family XIV.—HETERODONTIDÆ.

(*The Port Jackson Sharks.*)

Sharks with two dorsal fins, both provided with spines; the first dorsal opposite to the space between pectorals and ventrals; the second in advance of the anal. Body elongated, obtusely trihedral, gradually tapering from the anal region towards the caudal fin; head high, with the forehead declivous, little prominent; nostrils confluent with the mouth; mouth rather narrow, the upper lip divided into seven lobes, the lower with a fold; spiracles small, below the lower part of the eye; no nictitating membrane; gill-openings rather narrow; dentition similar in both jaws, viz, small obtuse teeth in front, which in the young are pointed, and provided with three to five cusps; the lateral teeth large, pad-like, twice as broad as long, arranged in oblique series, one series being formed by much larger teeth than those in the other series; caudal fin moderate. Genera 1, 2, or 3; species about 4; inhabiting the Pacific Ocean. Of much interest to palæontologists from their supposed relation to certain extinct types. (*Cestraciontidæ* Günther, viii, 417, 418; but *Heterodontus* has priority over *Cestracion.*)

* Branchial region longer than high, the slits being little elongated; molar teeth flat and closely contiguous ..... GYROPLEURODUS, 31.

31.—GYROPLEURODUS Gill, 1862.

(Gill, Proc. Ac. Nat. Sci. Phila. 1862, 489; type *Cestracion francisci* Girard.)

The characters distinguishing this group from *Heterodontus* are thus given by Professor Gill:

"In the latter genus, the branches of the lower jaw are at first contiguous and diverge from each other at an acute angle, while in front of the oblique whorls of molars, and between the acute teeth of the front which encroach on the sides, a cordiform area exists. The lateral or molar teeth are numerous, and arranged in oblique whorls, which rapidly increase in size to the fifth, behind which they again decrease. The branchial apertures are also comparatively large, the first being longer than the length of the branchial region.

"In *Gyropleurodus*, the branches of the lower jaw are widely separated by an interval rounded in front and becoming wider behind, the sides themselves being curved outwards; the acute teeth are confined to the front and the molar teeth are few and disposed in about four whorls, the first three of which slightly increase, while the fourth is almost rudimentary. The branchial area is almost oblong."

Head short and high, broad, but with subvertical sides; the forehead very declivous from eyes, and with the snout wide and transverse, but prominent; two blunt, diverging ridges are continued from each side of the snout and abruptly merge into the more conspicuous superciliary ridges, the interval between which is nearly plane; teeth in front digitated, with three or four cusps, quincuncially distributed in rows slightly converging toward the middle; in the upper jaw, on the sides, molars oblong and flattened, arranged in about four oblique whorls, uniform or increasing backward, except the last, which is smallest; on the sides of the lower jaw, also, are molars oblong, with flattened crowns, and arranged in transversely oblique whorls, but decreasing backward (*Gill*). One species known. (γῦρος, ring or whorl; πλευρὸν, side; ὀδοῦς, tooth.)

41. G. francisci (Grd.) Gill.

Dorsal fins considerably produced backward at their posterior angle; the compressed spine forming about half of the base of each fin; anal fin large, directed very obliquely backwards, reaching the root of caudal; caudal fin forming about one fourth of the length; color brownish, variegated with sparsely scattered small black spots all over the body and fins. Coast of California (*Gill*).

(*Cestracion francisci* Girard, Proc. Ac. Nat. Sci. Phila. 1854, 196; *Cestracion francisco* Günther, viii, 416; Gill, Proc. Ac. Nat. Sci. Phila. 1862, 492.)

Family XV.—HEXANCHIDÆ.

(The Cow Sharks.)

Body elongated, somewhat depressed anteriorly, tapering towards the caudal fin. Head depressed, oblong and semi-oval or semi-elliptical above, with the snout projecting. Eyes submedian or anterior, without nictitating membranes. Mouth inferior, large, arched in front, no labial fold. Teeth in the two jaws unlike; in the upper jaw one or two pairs of awl-shaped teeth, the next six teeth broader, and each provided with several cusps, one of which is much the strongest. Lower jaw with six large comb-like teeth on each side, besides the smaller posterior teeth. Spiracles small, on the side of the neck. *Only one dorsal fin, without spine, opposite the anal*, and similar to it. No pit at the root of the caudal fin. Gill-openings wide, *six or seven* in number. Genera 2; species 4 or more; mostly of the Eastern Atlantic. (*Notidanidæ* Günther, viii, 397–399.)

* Gill-openings seven on each side ..... Heptancus, 32.

32.—HEPTANCUS Rafinesque, 1810.

Perlons.

(*Notidanus* Cuvier, 1817.)

(*Heptranchias* Rafinesque, Caratteri di Alcuni Nuovi Generi, etc.: type *Squalus cinereus* Gmelin.)

Characters same as those of the family with the addition of *gill-openings seven*, which separates this genus from *Hexanchus*. (ἑπτὰ, seven; ἀγκος, bend or sinus, for gill-opening.)

* Median tooth of lower jaw without central cusp. (*Notorhynchus* Ayres.)

42. H. indicus (Cuvier) Müller & Henle.

"Snout short and rounded; cleft of the mouth broader than long. A single median pointed tooth in the upper jaw; the lower median tooth with lateral cusps, but without central cusp. The first cusp of the lower teeth is much stronger than the others and serrated on its outer margin."—(*Günther.*) Dark bluish gray, with many small irregular black blotches. Tail more than one third of total length. Size large. Cape of Good Hope to California; not rare at San Francisco.

(*Notidanus indicus* Cuvier, Règne Animal: *Notidanus indicus* Günther, viii, 398: *Notorhynchus maculatus* Ayres, Proc. Cal. Nat. Sci. i, 72: *Notorhynchus maculatus* Gill, Proc. Ac. Nat. Sci. Phila., 1862, 495, and 1864, 149: *Notorhynchus borealis* Gill, Proc. Ac. Nat. Sci. Phila. 1864, 150.

SUPER-FAMILY SQUATINOIDEA.

(*The Squatinoid Sharks.*)

FAMILY XVI.—SQUATINIDÆ.

(*The Angel Sharks.*)

Ray-like sharks. Body depressed and flat; mouth anterior; teeth conical, pointed, distant; pectoral fins very large, expanded in the plane of the body, but free from it, being deeply notched at the base; ventral fins very large; two small subequal dorsal fins behind the ventrals; no anal fin; caudal fin small; gill-openings wide, subinferior, partly covered by the base of the pectoral; spiracles wide, crescent-shaped; behind the eyes; nostrils on the front margin of the snout, with skinny flaps. A single genus, with perhaps but one species. Sharks of singular appearance, inhabiting most seas. (*Rhinidæ* Günther, viii, 430.)

33.—SQUATINA Duméril, 1806.

Angel Sharks.

(*Rhina* Klein.)

(Aldrovandi, Duméril, Zool. Anal. 1806, : type *Squalus squatina* L. = *Squatina angelus* Dum.)

The characters of the genus are included above. (*Squatina*, the Latin name of *S. angelus*, from *squatus*, skate.)

43. S. angelus Duméril.—*Angel-fish; Monk-fish; Angel Shark.*

Bluish ash-gray above, much blotched and speckled; beneath white; caudal fin short triangular, lower lobe longest; dorsal fins short and high; skin rough, with small stiff prickles, largest along the middle line of the back; eyes small. A small shark, with expanded pectorals, like a ray, found in most warm seas, not very common on our coasts. Our species has been generally considered as distinct from the European, under the name *S. dumerili*, but without evident reason. A species considered by Dr. Günther to be identical with *Squatina angelus* also occurs on our Pacific coast.

(*Squalus squatina* L. Syst. Nat.: *Squatina angelus* Duméril, Zool. Anal. 102: *Squalus dumerili* Le Sueur, Journ. Ac. Nat. Sci. Phila. i, 225: *Rhina squatina* Günther, viii, 430: *Squatina californica* Ayres, Proc. Cal. Ac. Nat. Sci. 1859, 29.)

ORDER E.—RAIÆ.

(*The Rays.*)

Gill-openings inferior, slit-like, five in number; spiracles present; no anal fin; dorsal fins, if present, inserted on the tail; body typically disk-like, broad and flat, the margin of the disk being formed by the expanded pectorals. Tail comparatively slender, the caudal fin small. With the exception of the *Raiidæ*, most or all of the rays are ovo-viviparous. (Suborder *Batoidei* Günther, viii, 434–498.) (Latin, *raia* or *raja*, a ray.)

* Tail comparatively thick, usually with rayed dorsal and caudal fins; no serrated caudal spine nor separate cephalic fins. (*Pachyura.*)

a. Snout saw-like, much produced, armed with strong lateral teeth ..PRISTIDÆ, 17.

aa. Snout not saw-like.

b. Disk passing gradually into the long stout tail; pectorals not extending to the snout .....RHINOBATIDÆ, 18.

bb. Disk abruptly contracted at base of the tail.

c. Electric organs present; disk perfectly smooth.....TORPEDINIDÆ, 19.

cc. Electric organs absent; disk and tail more or less prickly .....RAIIDÆ, 20.

** Tail very slender, whip-like, its fins, if any, small and near its base. (*Masticura.*)

d. Pectoral fins uninterrupted, confluent around the snout; teeth small.

TRYGONIDÆ, 21.

dd. Pectoral fins interrupted, the appendages on the snout ("cephalic fins") separate from the pectorals.

e. Teeth large, flat, tessellated.....MYLIOBATIDÆ, 22.

ee. Teeth very small, flat or tubercular.....CEPHALOPTERIDÆ, 23.

SUPER-FAMILY PRISTOIDEA.

(*The Pristoid Rays.*)

FAMILY XVII.—PRISTIDÆ.

(*The Saw-fishes.*)

Body elongate, depressed; pectoral fins moderate, the front margin quite free, not extending to the head; snout produced into a very long, thin, flat blade, which is armed with a series of strong tooth-like processes along each edge; teeth in jaws minute, obtuse; gill-openings moderate, inferior; spiracles wide, behind the eye; nostrils inferior; no tentacles; no nictitating membrane; dorsal fins large, without spine, the first nearly opposite the ventrals. Caudal well developed, bent upwards; a fold along each side of tail. A single genus, with five or more species, inhabiting warm seas, sometimes ascending the rivers. A family of sharks, *Pristiophoridæ*, similarly armed with a "saw," occurs in the Pacific Ocean. (*Pristidæ* Günther, viii, 436–439.)

34.—PRISTIS Latham, 1794.

Saw-fishes.

(Latham, Trans. Linn. Soc. ii, p. 276: type *Squalus pristis* L. = *Pristis antiquorum* Latham.)

The characters of the genus are included above. (πρίστης, the ancient name of the saw-fish, from πρίστης, a sawyer.)

44. P. antiquorum Latham.—*Saw-fish.*

Anterior dorsal opposite ventrals; caudal fin without lower lobe; rostral teeth in 16 to 20 pairs, nearly equidistant, stout, provided with a cutting anterior edge; the size of the teeth subject to considerable variations; caudal fin without lower lobe; color grayish. Length 10 to 15 feet. Atlantic Ocean; common on both shores, especially southward; probably entering rivers.

(*Squalus pristis* L. Syst. Naturæ: *Pristis antiquorum* Latham, Trans. Linn. Soc. 1794, ii, 297; Günther, viii, 438.)

Family XVIII—RHINOBATIDÆ

(*The Long-nosed Rays.*)

Shark-like rays. Trunk gradually passing into the long and strong tail, which is provided with two well-developed dorsal fins, a caudal fin and a conspicuous dermal fold on each side; disk not broad, the rayed portion of the pectoral fins not being continued to the snout; no conspicuous spines, the skin being nearly smooth; no electric organs. Genera 3 to 5; species about 15; inhabiting warm seas. The form of the body is as much shark-like as is that of the shark *Squatina*. (*Rhinobatidæ* Günther, viii, 440–448.)

* First dorsal much behind the ventrals; anterior nasal valves not confluent.

RHINOBATUS, 35.

35.—RHINOBATUS Bloch & Schneider, 1801.

(Schneider ed. Bloch, Ichthy.: type *Rhinobatus rhinobatus* Bloch & Schneider=*Rhinobatus granulatus* Cuv.)

Body depressed, gradually passing into the tail. Cranial cartilage produced into a long rostral process, the space between the process and the pectoral fin being filled by membrane. Spiracles wide, behind the eye; nostrils oblique, wide; anterior valves not confluent. Teeth obtuse, with an indistinct transverse ridge. Dorsal fins without spine; both at a great distance behind the ventral fins. Caudal fin without lower lobe. (ῥινη, a shark, *Squatina*; βατος, a skate.)

45. R. productus Ayres.

"The anterior nasal valve is dilated into a very narrow lateral fold, scarcely projecting beyond the nasal margin. The length of the nostril is slightly more than its distance from the lateral margin of the head and more than the distance between the inner angles of the nostrils, and much less than the width of the mouth, which is very slightly arched. Snout produced, the distance between the outer angles of the nostrils being $\frac{3}{5}$ of that between the mouth and the end of the snout. A series of small, depressed, polished spines along the median ridge of the back; groups of small, polished tubercles on the orbital margin and on the shoulder. A broad groove between the rostral ridges, which are separated along their entire length. Snout lighter colored than the rest of the body."—(*Streets.*) Coast of California and southward.

(Ayres MSS.; Girard, Proc. Ac. Nat. Sci. Phila. 1854, 196; Streets, Bull. U. S. Nat. Mus. vii, 1877, 55: *Rhinobatus leucorhynchus* Günther, viii, 444.)

SUPER-FAMILY TORPEDINOIDEA.

(*The Torpedinoid Rays.*)

FAMILY XIX.—TORPEDINIDÆ.

(*The Numb-fishes.*)

Rays with the trunk broad and smooth; the tail comparatively short and thick, with rayed caudal fin, and commonly two rayed dorsal fins the first of which is over or behind the ventrals; a longitudinal fold on each side of tail; anterior nasal valves confluent into a quadrangular lobe; an electric organ composed of hexagonal tubes between the pectoral fins and the head. Genera 6; species about 15; large rays, noted for their power of giving electric shocks; found in most seas. (*Torpedinidæ* Günther, viii, 448–455.)

* Dorsal fins two; ventrals separate; spiracles well behind the eyes....TORPEDO, 36.

36.—TORPEDO Duméril, 1806.

Electric Rays.

(Duméril, Zool. Analyt. p. 102: type *Raia torpedo* L.)

Electric rays with the disk very broad, abruptly contracted at the tail; two dorsal fins; caudal fin well developed; ventral fins large, separate; spiracles large, placed behind the eyes; mouth small; teeth pointed; skin perfectly smooth. Large rays, chiefly inhabiting the Atlantic.

46. T. occidentalis Storer.—*Cramp-fish; Torpedo; Numb-fish.*

First dorsal more than twice as large as second, placed over the ventrals; spiracles not fringed, their edges smooth; color almost uniform black, with obscure darker spots; beneath white; length 2 to 5 feet; breadth $\frac{3}{4}$ of length, the disk very blunt or almost emarginate in front. Atlantic coast; not very common.

(Storer, Am. Journ. Sci. Arts, 45, p. 165; Storer, Fishes Mass. 247.)

47. T. californica Ayres.—*California Cramp-fish.*

Dark grayish brown above, thickly spotted with black; disk broad and rounded, forming more than half the entire length; teeth small, very sharp. Coast of California. (*Ayres.*)

(Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 70.)

SUPER-FAMILY RAIOIDEA.

(*The True Rays.*)

FAMILY XX.—RAIIDÆ.

(*The Skates.*)

Rays with the disk broad, rhombic, more or less spinous or rough; tail stout, rather long, with a longitudinal fold on each side, the skin commonly rough with spines; usually two dorsal fins and sometimes a caudal fin present on the tail; pectoral fins extending to the snout; ventrals large; no serrated spine on the tail; no electric organs; oviparous, the eggs being laid in large leathery egg-cases, four-angled, with two long tubular "horns" at each end. Genera 4 or more; species 40, most of them belonging to the genus *Raia*. Skates of generally small size; found in all seas.

* Caudal fin rudimentary or absent; pectorals not confluent around the snout; ventrals deeply notched ..... RAIA, 37.

37.—RAIA Linnæus, 1758.

Rays.

(Artedi—Linnæus, Syst. Nat. : type *Raia clavata* L.)

This genus, as here understood, comprises all those *Raiidæ* which have the pectoral fins not continued around the snout, the ventrals deeply notched, and the caudal fin little developed or wanting; the tail is very distinct from the disk, and is provided with two rayed dorsal fins; the skin of the body is usually more or less spinous; the dentition differs in the two sexes, and the male is usually provided with a differentiated patch of spines on each pectoral. Species numerous.

Our knowledge of the American species has been in a state of great confusion until very lately, the first careful comparison of the species having been made by Mr. Garman in 1874. On his excellent paper* the following account is based. (*Raia or Raja*, the Latin name of fishes of this genus.)

1.—*Atlantic Species.*

* Outline of the disk anterior to the spiracles rounded, not forming an angle at the tip of the snout.

† Rows of teeth about $\frac{50}{48}$.

48. R. erinacea Mitchill.—*Common Skate; Little Skate; Tobacco-box.*

Form rhomboid, with all the angles rounded; spines largest on the anterior extensions of the pectorals, where they are close-set, strong, laterally compressed and hooked backwards; smaller ones are scattered over the head, above the spiracles, above and in front of the eyes, on the back, the median line of which is comparatively smooth, without larger median series, except in the young. A triangular patch on the shoulder-girdle; inner posterior angles of the pectorals nearly smooth; in the males near the exterior angles of the pectorals are two rows of large erectile hooks, pointing backwards. Females with groups of small scales on each side of the vent; teeth small, the middle ones sharp in the males; all blunt in the females; jaws much curved; each side of tail with a dermal fold; caudal fins rough, not separate to the base. Color light brown, with small round spots of dark brown; females larger than the males. L. 1 to 2 feet (*Garman.*) The smallest and commonest of our skates; abundant on our coast, especially northward.

(*Raia erinacea* Mitchill, Am. Journ. Sci. Arts, xi, 290, 1825: *Raia eglanteria* Günther, viii, 462; Garman, l. c. 176.)

†† Rows of teeth $\frac{90}{88}$ ($\frac{80}{78}$ to $\frac{110}{108}$).

49. R. ocellata Mitchill.—*Ocellated Ray; Big Skate.*

General form and appearance of the preceding; the arrangement of spines similar, except that additional rows of spines are present down the back and along the sides of the tail; caudal fin not separate, rough with small spines; jaws curved. Color light brown, with rounded dark spots; a translucent space on each side of the snout; near the posterior angle of the pectoral there is usually (but not always) a large white ocellus, with a dark spot in the centre and a darker border; two smaller similar spots often present (*Garman*). Size very much larger than the

* On the Skates (Rajæ) of the Eastern Coasts of the United States: By S. W. Garman. <Proc. Bost. Soc. Nat. Hist. xvii, Nov. 4, 1874, pp. 170–181.

preceding species, reaching a length of nearly three feet. The egg-cases are more than twice as large as those of the smaller species.

(Mitchill, Trans. Lit. & Phil. Soc. i, 477, 1815: *Raia diaphanes*, pt.; Storer, Fish. Mass. 240; Garman, l. c. 177.)

** Outline of the disk anterior to the spiracles forming a more or less marked angle at the tip of the snout.

‡Angle at tip of snout short and obtuse; rows of teeth $\frac{40}{38}$; body and tail with large bucklers.

50. R. radiata Donovan.—*Starry Ray.*

In addition to the spines on the pectorals, head, back, and tail common to the preceding species, this species is marked by the presence of large spinous plates or bucklers. These are large strong spines, with broad stellate or shield-like bases. They are arranged as follows: One or two in front of each eye; one on each side between the eye and the spiracle; a pair on the shoulder, the smaller in front; and fourteen or more forming a dorsal row, beginning just back of the head and extending to the caudal. An irregular row of spines on each side of the tail, separated from the membrane by a band of shagreen; males with two or more rows of claw-like spines on the pectorals. Teeth with a long sharp point, rising from the middle and hooking backwards in the male, bluntish in the female; females larger than the males and more spinous. (*Garman*). Size medium. L. 1½ to 2 feet. North Atlantic; found both in America and Europe.

(*Raia radiata* Donovan, Hist. Brit. Fish. v, pl. 114, 1820; Günther, viii, 460; Garman, l. c. 177: *Raia americana* DeKay, 260.)

†† Angle at tip of snout acute, moderately produced; rows of teeth $\frac{50}{48}$.

51. R. eglanteria Lacépède.—*Brier Ray.*

Prickles comparatively small and very sharp, most numerous on the anterior portion of the pectoral, over the head, on the snout, on the middle of the back, and on the tail between the rows of larger ones; enlarged spines present around the eyes and spiracles, on the middle of the snout, in a median row along the back, and in two rows along each side of the tail; these spines very sharp, larger and smaller ones alternating in the rows; a large spine in the middle of each shoulder; a spine between the caudal fins. Color brown, with bands, bars, lines, blotches, and spots of darker in the middle of the pectoral; a translu-

cent space on each side of the rostrum. (*Garman.*) L. about 2 feet. Atlantic coasts of the United States; not very common.

(*Raia eglanteria* Bosc, MSS; Lacépède, Hist. Nat. des Poiss. ii, 103: *Raia desmarestia* Le Sueur, Journ. Ac. Nat. Sci. iv, 100: *Raia chantenay* Le Sueur, l. c. 103; Garman, l. c. 179.)

‡‡ Angle at tip of snout much produced, blunt; rows of teeth $\frac{32}{30}$.

52. R. lævis Mitchill.—*Barndoor Skate.*

Angles of the disk more acute than in any of the others; muzzle much produced, somewhat shovel-shaped at tip. Spines of the body very few and small. Some present above the eyes and spiracles, on the snout, along the anterior border of the pectorals, and on the back; those on the back very small. A median dorsal row of larger hooked spines extending along the median line of the posterior portion of the back and the tail. Usually two lateral rows on the tail. Female rougher, as usual among rays. Color variable, brownish, with paler spots, which are usually ringed with darker. The largest of our Atlantic species, reaching a length of about four feet. Virginia northward; not uncommon.

(Mitchill, Amer. Monthly Mag. ii, 327, 1817; Storer, Hist. Fish. Mass. 1867, 242; Garman, l. c. 180.)

53. R. granulata Gill.

"A remarkable species, with the back and ventral surface covered with minute sharp granular ossifications, obtained by Capt. Joseph W. Collins on Le Have Bank. A species of the same type as *R. lævis*, and having 30 to 31 teeth on each side; the back granulated and slate colored; the ventrals distinguished by reticulate markings, and the claspers slender and scarcely expanded." (*Gill.*)

(Gill MS.; Goode & Bean, Bull. Essex Inst. xi, 1879, 28.)

2.—*Pacific Species.*

54. R. cooperi Girard.—*Big Skate.*

Disk broad, its widest part behind the middle. Snout long, regularly long-acuminate, but not very sharp at tip, the anterior outline of the pectoral not much undulated, and little concave. Interorbital space very broad, almost flat, slightly depressed in the middle. Supraocular ridge scarcely elevated. Eyes small, shorter than the spiracles. Spines on body small and few. Two or three small spines around the eye. One or two near the centre of the back. Otherwise none on median line of back, in front of *base of ventrals*, where a series of spines begins, feeble

anteriorly, but growing larger backward. Females (as in other species) with lateral series of spines on the tail. Upper surface mostly covered with minute prickles, which are largest on the median line of the back, on the tail, and the front of the pectorals. Disk smooth below, except anteriorly. Teeth about $\frac{48}{38}$, the jaws rather strongly arched. Disk one-fifth broader than long, its width twice the length of the tail. Snout $3\frac{1}{2}$ in length of disk, $2\frac{3}{4}$ interorbital width. Color brown, with a dark ring at base of pectorals. Upper surface everywhere with round pale spots. The largest of our skates, reaching a length of over six feet. The egg-case nearly a foot long. Abundant on the Pacific coast from Monterey to Sitka.

(Girard, U. S. Pac. R. R. Exp. Fish. 372; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 135.)

55. R. rhina Jor. & Gilb.

Disk broad, the outer pectoral angle sharp, farther forward than in *R. cooperi.* Anterior outline of pectoral somewhat undulated and exceedingly concave, so that the snout is very long, acuminate, and tapering to the extreme point. Interorbital space quite narrow, little concave. Supraocular ridges slightly elevated. Eyes large, much longer than spiracles. Spines on body comparatively strong; five to seven above the eyes; two or three near the middle of the back; none on the median line of the back until opposite the posterior end of ventrals, where a series of rather sharp spines begins. Prickles on body above rather large, sharp, strongly stellate; those on the snout largest and most stellate. Skin above everywhere prickly in the female; the prickles small and sparse on the base and edges of the pectorals and on ventrals; larger on the median region of the disk. Male with bases of fins smooth, and the prickles generally fewer and smaller; anterior edge of pectoral with spines. Under side of disk almost everywhere prickly in the females, smooth posteriorly in the males. Mouth somewhat arched. Teeth $\frac{46}{40}$. Color light brown, nearly plain, with a dark ring at base of pectorals, which grows obscure with age. Disk one-tenth broader than long, its breadth twice the length of the tail. Snout nearly one-third the length of the disk, $3\frac{3}{4}$ times the interorbital width. L. $2\frac{1}{2}$ feet. Monterey to Puget's Sound; not rare.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, —.)

56. R. binoculata Girard.—*Common Skate* (of California).

Disk broad, its widest part well forward; outer angle of pectoral blunt; posterior edge convex; anterior margin of pectoral undulated, not

strongly concave; snout rather pointed and projecting at tip, but not very long, its acumination being confined to its anterior half. Interocular space narrow, deeply and uniformly concave. Eyes large, longer than spiracles. Supraocular ridge prominent. Spines on body rather stronger than in related species. Four or five over the eye; five or six (rarely fewer) along the median line, in front of the middle of the back. A series of very small spines along the middle of the back, changing opposite the middle of the ventrals into a series of rather strong hooked spines. Tail with a strong lateral series in females only, as usual in the genus. Prickles on the body small and few. A small band of sparse prickles near the median line of back on each side of the median series of spines. Snout and interorbital space prickly. No prickles on the shoulders or on the fins, except the anterior edge of the pectorals. Below smooth, except the snout and front of pectorals. Teeth $\frac{40}{42}$. Jaws somewhat curved. Color light brown, slightly mottled; a blackish ring at base of pectorals, which becomes faint in the adult. A small dusky spot at base of ventrals and on posterior edge of pectorals. Disk one tenth broader than long, its breadth twice the length of the tail. Snout one-fourth the length of the disk, three times the interorbital width. L. 2 feet. Coast of California, from Monterey to Cape Mendocino; abundant.

(Girard, Proc. Ac. Nat. Sci. Phila. 1854, 196: *Uraptera binoculata* Girard, U. S. Pac. R. R. Expl. Fishes, 373; Günther, viii, 464.)

Var. **inermis** Jordan & Gilbert (var. nov.).

Differs in the small number and feebleness of the spines and prickles, and in the presence of a band of small prickles (in the females) on the posteror part of the pectorals, parallel with the edge. Supraocular spines almost obsolete. Two or three minute prickles often present at the shoulder. A series of minute stellate prickles beginning near the middle of the back, becoming hooked spines on the tail. Lateral caudal spines scarcely differentiated. A band of small prickles on posterior part of the back. Males almost smooth. Santa Barbara, Cal.

57. R. stellulata Jordan & Gilbert.

Disk much broader than long, anteriorly broadly arched; the snout very obtuse, but its tip slightly exserted and acutish; anterior margin of pectorals somewhat undulated and convex; posterior margin very convex. A row of stout supraocular spines; about six spines on the scapular region, and a median row of strong spines on the tail. Entire upper surface rough with strong stellate prickles; these largest on

head, middle of back, and on tail. Under side smooth except anteriorly. Teeth $\frac{4}{3}\frac{0}{5}$. Color brown, everywhere strongly variegated with light and dark colors; a black spot at base of each pectoral, surrounded by a pale ring, and this by a black ring; numerous black spots of various sizes, some of them ocellated, scattered over the body; head with black cross-bars.

Disk one-fifth broader than long; the length of tail more than half the width of disk; the snout $4\frac{1}{2}$ in length of disk, and $2\frac{1}{2}$ times the interorbital width; the snout is as long as in *binoculata*, but much wider, appearing blunt and short. L. $2\frac{1}{2}$ feet. Bay of Monterey, California; locally abundant.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 133.)

Family XXI.—TRYGONIDÆ.

(*The Sting Rays.*)

Disk usually more or less broader than long; the pectoral fins uninterruptedly confluent in front, forming the tip of the snout; tail variously formed, usually whip-like, sometimes short and stout, sometimes bearing a single dorsal or caudal fin, but never with two dorsals. Usually one or more vertical folds of skin on the tail, rarely a lateral fold. Tail generally armed with a large, sharp, retrorsely serrate spine on its upper surface, toward the base (two or three spines occasionally present). Ventral fins not emarginate. Skin smooth or variously prickly or spinous, roughest on the adult. No differentiated spines on the pectorals in the males, the sexes being similar. Mouth rather small. Teeth small, paved, usually more or less pointed or tubercular. Nostrils near together; nasal valves forming a rectangular flap, which is joined to the upper jaw by a narrow frenum. Spiracles large, placed close behind the eyes. Skull not elevated, the eyes and spiracles superior. Ovoviviparous. Genera about 10; species 50. Found in most warm seas, some of them in the fresh waters of Central and South America. The large spine on the muscular tail is capable of inflicting a severe and even dangerous wound.

(*Trygonidæ* Günther, viii, 471–488.)

Tail stout, provided with a rayed caudal fin ..... Urolophus, 38.
**Tail slender, without caudal fin.
  †Tail very short, shorter than the broad disk ..... Pteroplatea, 39.
  ‡‡Tail whip-like, longer than the disk ..... Dasyatis, 40

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* In the key to the families of *Raiæ*, on page 36, the character assigned to *Trygonidæ*, "Tail very slender, whip-like, its fins, if any, small and near its base," does not apply to the genus *Urolophus*, and should be modified. All the "Pachyura" have two dorsals and a trace at least of a caudal fin. In the "Masticura" one or more of these fins are obsolete, and a serrated caudal spine is generally present.

38.—UROLOPHUS Müller & Henle.

Round Sting Rays.

(Müller & Henle, Plagiostomen, 1837, 173: type *Urolophus aurantiacus* Müller & Henle = *Raia cruciata* Lacépède.)

Disk oval or rhombic, the length and breadth not very unequal. Snout rounded or slightly prominent. Skin smooth or somewhat prickly. Tail rather short, little if any longer than the disk, muscular, provided with a distinct rayed caudal fin; no dorsal fin. Upper part of the tail with a strong serrated spine. Warm seas. Size small. (*οὐρά*, tail; *λόφος*, crest.)

* Skin perfectly smooth.

58. U. halleri Cooper.

Disk nearly round, a little broader than long, with the anterior margins straightish, meeting in a slight angle. Snout (from the eyes) longer than the width of the interorbital space. Tail somewhat shorter than the disk. Skin without spines or prickles. Color light brownish, with marblings and wavy lines of yellowish and dusky, sometimes with yellowish spots, occasionally with wide, obscure dusky streaks, which are crossed by similar transverse streaks. Belly yellowish tinged. Coast of California, from Point Concepcion southward; exceedingly abundant in sheltered bays. L. 12. The smallest of our sting rays. Closely related to the Australian *U. cruciatus*, if not identical with it.

(Cooper, Proc. Calif. Ac. Nat. Sci. iii, 95.)

39.—PTEROPLATEA Müller & Henle.

(Müller & Henle, Plagiostomen, 1837, 168: type *Raia altavela* L.)

Disk much broader than long, its anterior margins meeting in a very obtuse angle, its outer angles more or less acute. Tail very short and slender, shorter than the disk, without fin, usually armed with a small serrated spine. Skin smooth or very nearly so. Size moderate or rather large. Warm seas. (*πτερά*, fins; *πλατέα*, broad; *πτεροπλατεῖα*, an ancient name of *P. altavela*.)

*Spiracle without tentacle.

59. P. maclura (Le Sueur) Müller & Henle.—*Butterfly Ray.*

Disk scarcely twice as broad as long, covered with perfectly smooth skin. Tail about one-third as long as the disk, with a very slight dermal fold above and below. Snout a little projecting, so that the anterior edge of each pectoral is somewhat concave. Color brownish olive, finely marbled with grayish, and finely speckled. Anterior edge of disk

with half spots of paler. Tail with four dark blotches above, forming half rings. (Caudal spine wanting in all the specimens examined.) Virginia to Brazil; not uncommon.

(*Raia maclura* Le Sueur, Journ. Ac. Nat. Sci. Phila. 1817, 41; Duméril, Hist. Nat. Poiss. i, 614; Günther, viii, 487.)

60. P. marmorata Cooper.

Disk about twice as broad as long, covered with perfectly smooth skin. Tail $3\frac{3}{4}$ in length of disk, with a rather small cutaneous fold above and below, the lower fold the longer, the upper about as deep. Interorbital space a little shorter than the snout. Snout slightly prominent, but forming a very obtuse angle. Olive-brown, finely mottled everywhere with darker, the dark forming reticulations around pale roundish spots. Tail without dark rings. Caudal spine much smaller than in other sting rays; present in all specimens examined. Coast of California from Point Concepcion southward; common.

(Cooper, Proc. Cal. Ac. Nat. Sci. iii, 112.)

40.—DASYATIS Rafinesque.

Sting Rays.

(*Trygon* Adanson.)

(Rafinesque, Caratteri di Alcuni Nuovi Gen. 1810, 16: type *Dasyatis ujus* Rafinesque = *Raia pastinaca* Linnæus.)

Disk oval, flat, with rounded angles. Tail very long and slender, whip-like, without fin, but often with one or two vertical membranaceous folds. A strong serrated spine toward the base of the tail. Skin more or less spinous or prickly, rarely smooth. Teeth small, paved. A few papillæ usually present in the mouth behind the lower jaw. Sting rays of large size, abundant in warm seas. Many of the spinous species are nearly or quite smooth when young. (δασύς, shaggy or rough; βάτις, a skate; hence properly *Dasybatis*.)

* Upper caudal fold obsolete; lower well developed. (*Hemitrygon* Müller & Henle.)

61. D. centrurus (Mitchill) Jordan & Gilbert.—*Common Sting Ray; Clam Cracker; Stingaree.*

Disk a little broader than long, its anterior angle obtuse. Tail relatively stout, about one-third longer than the disk. A well-developed fold below, but the upper fold reduced to a mere trace. Disk perfectly smooth in the young, with more or less of tubercles along the median line of the back and the scapular region in the adult. Buccal papillæ 3. Width of mouth about half its distance from the tip of the snout.

Caudal spine 1½ times width of mouth. Spiracles very large. Color nearly uniform brownish. L. 8 feet. Cape Cod to Florida; common. (Perhaps includes more than one species.)

(*Raia centrura* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 479: *Pastinaca hastata* Dekay, New York Fauna, Fishes, 373: *Trygon hastata* Günther, viii, 476.)

** Upper and lower caudal folds well developed. (*Dasyatis.*)

62. D. sayi (Le Sueur) Goode & Bean.

Disk rhomboidal, a little broader than long, the muzzle moderately prominent. Width of mouth contained about 2½ times in the length of the snout. Tail with two well-developed folds, the lower fold considerably the larger, both smaller than in *D. dipterurus*. Tail slender, prickly, nearly twice as long as the disk; its spine extremely long; its length 2½ times the width of the mouth. Skin smooth in the young, becoming roughish with age. Several rather strong recurved spines along the middle line of the back. Spiracles moderate. Buccal papillæ 5 (7). Color brownish. South Atlantic States to Brazil.

(*Raja say* Le Sueur, Journ. Ac. Nat. Sci. Phila. 1817, 42: *Trygon sayi* Duméril, Elasmobranch. 603: *Trygon pastinaca* part Günther, viii, 478.)

63. D. dipterurus Jordan & Gilbert.

Disk rhomboid, slightly broader than long, anterior margins nearly straight, meeting anteriorly in a very obtuse angle; posterior margins curved; lateral angles rounded; tail nearly half longer than the disk, with a conspicuous cutaneous fold below and a smaller but evident one above; jaws considerably arched; buccal papillæ 3; teeth $\frac{21}{23}$. Young perfectly smooth. Adult with a row of low but rather stout tubercles on the median line of the scapular region and two others on the humeral region. Tail with small prickles. Caudal spine long, its length nearly 3 times the width of the mouth. Color bluish brown, nearly plain. L. 6 feet or more. Bay of San Diego, California; abundant.

(*Dasybatis dipterurus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 31.)

64. D. tuberculatus (Lacép.) Goode & Bean.

Disk rhomboidal, a little broader than long; anterior borders scarcely concave, the posterior almost straight; external angles rounded; muzzle pointed; tail below with a cutaneous fold, higher and longer than the upper fold, covered for its posterior two-thirds with small ossifications; tail nearly 2½ times length of disk. All the middle of the upper surface of the body, from the posterior region of the head to the base

of the tail, covered by an armature composed of a very great number of small bony tubercles. Along the median line an irregular series of tubercles with the base enlarged, almost quadrilateral, the points directed backward; a tubercle on the shoulder girdle on each side of the median line. Five papillæ in the mouth. Jaws strongly arched. Very young, almost smooth. Uniform brown. (*Duméril.*) Florida to Brazil.

(*Raia tuberculata* Lacépède, Hist. Poiss. ii, 106: *Trygon tuberculata* Duméril, Elasmobranch. 605: *Trygon tuberculata* Günther, viii, 480.)

65. D. sabinus (Le Sueur) Goode & Bean.

Disk oval-rhomboidal, scarcely longer than broad, the anterior borders lightly concave, united by rounded angles to the posterior borders, which are longer and a little convex; snout projecting; tail twice as long as the body; upper part of the head rough with small spines; on the middle of the back a row of tubercles commencing behind the head and prolonged on the base of the tail; 5 buccal papillæ; two spines on each side of the shoulder girdle; tail rough, with two short, low cutaneous folds; mouth strongly arched. Color uniform yellowish brown. (*Duméril.*) "Distinguished from *D. centrurus* by the shape of the disk, the shape of the caudal spine, and the wing-like membranes on the tail" (*Goode* in lit.). Perhaps identical with the preceding.

(*Trygon sabina* Le Sueur, Journ. Ac. Nat. Sci. Phila. 1824, iv, 109: *Trygon sabina* Duméril, Hist. Nat. Poiss. i, 607: *Trygon tuberculata* Günther, viii, 480, part.)

Family XXII.—MYLIOBATIDÆ.

(*The Eagle Rays.*)

Disk broad; the pectoral fins not continued to the end of the snout, but ceasing on the sides of the head and reappearing in front of the snout as one or two fleshy protuberances (cephalic fins), which are supported by fin rays. Tail very long and slender, whip-like, with a single dorsal fin near its root, behind which is usually a strong, retrorsely serrated spine. Nasal valves forming a rectangular flap, with the posterior margin free, attached by a frenum to the upper jaw. Skull less depressed than usual among rays, its surface raised so that the eyes and spiracles are lateral in position. Teeth hexangular, large, flat, tessellated, the middle ones usually broader than the others. Ovoviviparous. No differentiated spines on the pectorals in the males, the sexes being similar. Ventrals not emarginate. Genera 3; species about 20. Large

sting rays; inhabiting warm seas. Similar in habits to the *Trygonidæ*.

(Group *Myliobatina* Günther, viii, 488–495.)

* Muzzle entire.
  a. Teeth in a single series, very broad ..... AETOBATIS, 41.
  aa. Teeth in several series, the middle series very broad ..... MYLIOBATIS, 42.
** Muzzle emarginate; cephalic fins below the level of the disk; teeth in several series ..... RHINOPTERA, 43.

41.—AETOBATIS Müller & Henle.

Bishop Rays.

(Blainville; Müller & Henle, Plagiostomen, 1837: type *Raja narinari* Euphrasen.)

General form of *Myliobatis*. Muzzle entire. Teeth flat, broad, forming a single series corresponding to the middle series in *Myliobatis*, there being no small lateral teeth. Upper dental lamina straight, lower curved, the latter projecting beyond the upper. Free border of the nasal valve deeply emarginate. Skin smooth. Tropical seas. (ἀετός, eagle; βᾰτίς, ray.

66. A. narinari (Euphrasen) Müller & Henle.

Disk twice as broad as long, its anterior borders a little convex, posterior concave, outer angles pointed. Cephalic fin about one-third broader than long. Teeth of the lower jaw straight or more or less angularly bent. Tail 3 or 4 times length of disk. Brown, with small round pale spots. (*Duméril.*) Virginia to the Indian Ocean; not very common on our coast.

(*Raia narinari* Euphrasen, Vet. Ak. Nya. Handl. 1790, xi, 217: *Raia flagellum* Bloch, Schn. 361; Günther, viii, 492; Duméril Hist. Nat. Poiss. i, 642.)

42.—MYLIOBATIS C. Duméril.

Eagle Rays.

(Duméril in Cuvier Règne Animal, ii, ed. 1, 137, 1817: type *Raia aquila* Linnæus.)

Disk broad, the outer angles acute; cephalic fins forming a soft convex appendage in front of the snout; jaws about equal; median teeth very broad, much broader than long in the adult, proportionally narrower in the young; several series of narrower teeth on each side of the median series. Free edge of the nasal valve not deeply emarginate. Tail very long and slender, with a small dorsal fin and one or more serrated spines. Skin smooth or nearly so. Size large. In all warm seas. (μυλίας, a grinder; βᾰτίς, ray.)

67. M. freminvillei Le Sueur.

Disk broader than long, the breadth equal to the length of the tail. Skin entirely smooth. A blunt, whitish prominence over each eye. Muzzle prominent. Teeth of the main row 4 to 6 times broader than long; small teeth in three rows. Reddish brown. Tail nearly black. Cape Cod to Brazil; not uncommon.

(Le Sueur, Journ. Ac. Nat. Sci. Phila. iv, 111: *Myliobatis bispinosus* Duméril, Hist. Nat. Poiss. 637: *Myliobatis acuta* Storer, Hist. Fish. Mass. 245.)

68. M. californicus Gill.—*California Sting Ray; Batfish.*

Disk not quite twice as broad as long; the wings anteriorly convex, posteriorly somewhat concave. Cephalic fin very blunt, nearly 4 times as broad as long. Tail nearly twice as long as the disk. Ventral large, broader than long. Lateral teeth in 3 to 5 series on each side; median teeth only 3 to 4 times as broad as long, even in the adult. Skin wholly smooth. Color dusky brownish, the young somewhat variegated. San Francisco southward; very common on the Pacific coast.

(*Rhinoptera vespertilio* Girard, Boston Journ. Nat. Hist. 1857, 544: *Holorhinus vespertilio* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 331 (not *Myliobatis vespertilio* Bleeker); Gill, Ann. Lyc. Nat. Hist. N. Y. 1865, viii, 137.)

43.—RHINOPTERA Kuhl.

Cow-nosed Rays.

(Kuhl, Müller, Abhandlungen Ak. Wiss. Berl. 1836, 237: type *Rhinoptera brasiliensis* Müller = *Myliobatis jussieui* Cuvier.)

Disk broader than long, with the anterior angles more or less acute. Snout more or less emarginate on the median line. Cephalic fin emarginate and placed on a plane below the level of the pectorals, the snout thus appearing four-lobed. Free border of the nasal valve not emarginate. Teeth in 3 to 20 rows, the median teeth more or less enlarged, but often smaller than in *Myliobatis*. Tail long, whip-like, with a small dorsal fin and a serrated spine. Tropical seas. (ῥίν, snout; πτερόν, fin.)

69. R. quadriloba (Le Sueur) Cuvier.

Disk one-third broader than long; anterior borders almost straight, posterior undulated; muzzle deeply emarginate. Teeth in seven rows, the median teeth four times as broad as long. Tail very slender, a little longer than the disk. Skin smooth or nearly so. Color brownish. Cape Cod to Florida; not rare. Attains a large size.

(*Raia quadriloba* Le Sueur, Journ. Ac. Nat. Sci. i, 44; Günther, viii, 494; Duméril, Hist. Nat. Poiss. i, 648.

Family XXIII.—CEPHALOPTERIDÆ.

(*The Sea Devils.*)

Rays of enormous size, with the disk broader than long and the pectoral fins not continued on the sides of the head, the anterior or cephalic portion developed as two long ear-like appendages. Mouth wide, terminal or inferior. Teeth very small, flat or tubercular, in many series, those of the upper jaw sometimes wanting. Eyes lateral. Nostrils widely separated, their valves united, forming a flap as wide as the cleft of the mouth. Tail long and slender, whip-like, with a single dorsal fin at its base, and with or without a serrated spine. Ventral fins not emarginate. Skin more or less rough. Males without differentiated spines on the pectorals, the sexes similar. Ovoviviparous. Genera 2; species about 7. Largest of all rays and among the largest of all fishes. Found in the tropical seas.

(*Myliobatidæ*, group B. *Ceratopterina* Günther, viii, 496–498.)

* Teeth in lower jaw only; mouth terminal.....Manta, 44.

44.—MANTA Bancroft.

(*Ceratoptera* Müller & Henle.)

(Bancroft, Zoöl. Journal, 1828–'29, iv, 444: type *Cephaloptera manta* Bancroft = *Raia birostris* Walbaum.)

Disk broader than long, its exterior angles acute, the posterior margins of the pectorals concave. Head truncate in front; the cephalic fins long, turned forward and inward. Mouth large, terminal. Teeth minute, present in lower jaw only. Tail whip-like, often (always?) without serrated spine. Skin rough, with small tubercles. Two species known. (*Manta*, blanket, "a name used at the pearl fisheries between Panama and Guayaquil to designate an enormous fish much dreaded by the divers, whom it is said to devour after enveloping them in its vast wings.")

70. M. birostris (Walbaum) Jordan & Gilbert.—*Sea Devil; Devil Fish; Manta.*

Disk not quite twice as broad as long. Tail about as long as the disk. Teeth in about 100 longitudinal series, which are separated by distinct interspaces. Skin of body and tail everywhere covered with small stellate tubercles, rendering the surface very rough. Brownish, the

margins of the disk darker. (*Duméril.*) Tropical waters of America; north to North Carolina and San Diego. Reaches a width of about 20 feet.

("*Raia birostris* Walbaum": *Cephaloptera vampyrus* Mitchill, Ann. Lyc. Nat. Hist. N. Y. 1823, 23: *Diabolichthys elliotti* Holmes, Proc. Elliott Soc. Nat. Hist. 1856, 39: *Ceratoptera vampyrus* Duméril, Hist. Nat. Poiss. i, 660: *Ceratoptera vampyrus* Günther, viii, 498.)

SUBCLASS HOLOCEPHALI.

(*The Chimæras.*)

The characters of the single order.

ORDER F.—HOLOCEPHALI.

(*The Chimæras.*)

Skeleton cartilaginous. Gill-cavity with four clefts within, but having one external opening only, which is covered by a fold of skin, within which is a rudimentary cartilaginous operculum. No spiracles. Mouth inferior. Jaws without separate teeth, but armed with bony plates. Intestines with a spiral valve. No air-bladder. Jaws and palate coalescent with the skull. Derivative radii sessile on the sides of the basal bones of the limbs, separated from the articulation. Pectoral fins normally developed, placed low. Ventral fins abdominal. Tail tapering. Skin smooth or nearly so; its muciferous system well developed. A single family.

(*Holocephala* Günther, viii, 348–352; ὅλος, solid; κεφαλή, head.)

FAMILY XXIV.—CHIMÆRIDÆ.

(*The Chimæras.*)

Body elongate, rather robust anteriorly, tapering posteriorly. Head compressed. Mouth inferior. Upper lip deeply notched. Nostrils confluent with the mouth, separated by a narrow isthmus. Jaws with the teeth confluent into four bony laminæ above and two below. No spiracles. Males with a peculiar cartilaginous hook, armed with prickles at the tip, and turned forward on the upper part of the snout. Pectoral fins free, placed low. Ventral fins abdominal, many-rayed, provided in the male with claspers. Dorsal fin usually divided; anteriorly with a very strong spine, which is grooved behind. Caudal fin low, fold-like. Skin naked, rarely somewhat prickly. Lateral line present, usually with numerous branches anteriorly. Three free gills and two half gills,

one on each side. Isthmus moderate; gill-rakers small. Oviparous, the egg-cases long, elliptical, with silky filaments. Genera 2 (*Chimæra* and *Callorhynchus*); species about 5. Abounding in the seas of temperate and cold regions.

(*Chimæridæ* Günther, viii, 349-352.)

* Snout soft, not terminating in a cutaneous flap; tail not bent upward.. CHIMÆRA, 45.

45.—CHIMÆRA Linnæus.

Rat-fishes.

(Linnæus, Mus. Regis. Ad. Frid. i, 53; Syst. Nat.: type *Chimæra monstrosa* L.)

Head somewhat compressed, the snout bluntish, protruding, fleshy, not armed at tip with an appendage. Eyes very large, lateral. Teeth rather strong. Lips thickish, the lower with a frenum. Lateral line simple on the body, but forking anteriorly, forming several series of mucous tubes on the head. Male with a club-shaped, cartilaginous hook on the head, above the snout. This hook is curved forward and downward, and is armed at its tip with decurved spines. Its tip fits into a depression in front of the eyes. Gill-opening small. Pectorals moderate. Ventrals rather large, with large bifid or trifid claspers in the male. Male also with rough appendages at the base of the ventrals, protruding from a sheath of skin. First dorsal triangular, preceded by a strong spine which is grooved behind and serrated on its edges. Second dorsal and caudal fins low, often more or less notched. Tail extending in the line of the axis of the body, sometimes produced in a filament. Skin smooth. Fishes of singular appearance; mostly of the northern seas; not valued for food. (*Χίμαιρα*, *Chimæra*, a fabulous monster, with the head of a lion, body of a goat, and tail of a serpent.)

a. Claspers in the male trifid. (*Chimæra*.)

71. C. plumbea Gill.

"A *Chimæra* with the snout acutely produced; the ante-orbital flexure of the suborbital line extending little above the level of the inferior margin of the orbit; the dorsals close together; the dorsal spine with its anterior surface rounded; the ventrals triangular and pointed; the pectorals extending to the outer axil of the ventrals; and the color uniformly plumbeous." (*Gill.*) Atlantic coast from Cape Cod northward; in deep water.

(Gill, Proc. Philos. Soc. Washington, Dec. 22, 1877.)

aa. Claspers in the male bifid. (*Hydrolagus** Gill.)

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* Gill, Proc. Ac. Nat. Sci. Phila. 1862, 331: type *Chimæra colliei*. (*ὕδωρ*, water; *λαγὸς*, hare; from the form of the lips and teeth.)

72. C. colliæi Bennett.—*Rat-fish; Elephant-fish.*

Body anteriorly stoutish, tapering into a slender tail, which is not produced in a filament. Pectorals about as long as head. Dorsal spine $\frac{3}{4}$ the length of the head. Second dorsal low, highest in front, then very low, then higher, ending abruptly just before the beginning of the upper caudal fold. A small fold between first and second dorsal, free from both. Lower caudal fold higher than upper, neither quite reaching the tip of the tail. No distinct anal fin. Color grayish, with numerous round white spots. Both dorsals edged with blackish. L. 2 feet. Pacific coast, from Monterey northward; very abundant.

(Bennett, Beechey's Voy. Zoöl. 71; Duméril, Elasmobranches, 689; Günther, viii, 350.)

ADDENDA TO MARSIPOBRANCHII, ELASMOBRANCHII, ETC.

NOTE.—The first forty-one pages of the present work were printed in the spring of 1879, more than a year before work was resumed on the remaining part. Meanwhile numerous additions have been made to our list of sharks, which may be noticed here. A few errors may also be corrected.

Page 2, last line: For "*Epigonopterus*" read *Epigonichthys*".

Page 3: For "*B. caribæum*" read "1. *B. lanceolatum* (Pallas) Gray". The Lancelet occurs also on the coast of Southern California.

Page 6: For "3. *B. stouti* Lockington" read:

"**3. B. dombeyi** Müller.

"Plum-color or purplish, the edge of the lower fold only pale. Gills usually 12–11. Teeth 10 in each series. L. 20 inches. Snout 20 times in total length; head to first gill-opening $4\frac{1}{5}$; branchial region 8; tail 8. Coast of California and southward; not rare. Burrowing from the gill-openings or the eyes into the flesh of large fishes, and soon leaving nothing except the head, skin, and skeleton.

"(*Gastrobranche dombey* Lac.; Müller, Mém. de l'Acad. Berlin, 1834, 80: *Bdellostoma polytrema* Grd.; etc.)"

Page 7: *Lampetra* (*Entosphenus*)* *tridentatus* and *L. plumbea* are perhaps generically distinct, as the lingual teeth in the former are pectinate and in the latter obscurely tricuspidate. The diagnosis of *Lampetra* should be modified accordingly.

Page 8: "5. *L. epihexodon*" and "6. *L. astori*" should be suppressed, as they are probably identical with *E. tridentatus*.

Page 13: For "GINGLYMOSTOMATIDÆ" read "SCYLLIIDÆ"; and under "*i*" for "ventrals" read "pectoral".

Page 15: *Somniosus microcephalus* is abundant on the Pacific coast from Cape Flattery northward. Twelfth line from the bottom: For "pectorals" read "ventrals".

Page 17: Instead of "Family VI.—*Ginglymostomatidæ*", etc., read:

* Gill, MSS. Proc. Ac. Nat. Sci. Phila. 1862, 33, not characterized. (*εντος*, within; *σφην*, wedge; from the small maxillary tooth wedged in between the others.)

"FAMILY VI.—SCYLLIIDÆ.

"(*The Roussettes.*)

"Sharks with two dorsal fins, without spines, the first above or behind the ventrals. Anal fin present, usually below the second dorsal; caudal fin rather long, with or without a basal lobe. Tail not keeled. Spiracles present. No nictitating membrane. Last gill-opening above the root of the pectorals. Mouth usually broad, with small teeth, several series being in function. Teeth with a median cusp, and 1 to 4 small ones on each side. Usually a distinct furrow at the angle of the mouth. Nostrils near the mouth, sometimes confluent with it, sometimes provided with cirri. Oviparous. Coloration often variegated. The egg cases quadrate, with prehensile tubes at the angles.* Sharks of the warm seas. Genera 8 or 9; species about 30.

"(*Scylliidæ*, Günther, viii, 400–414.)

"* Nostrils confluent with the mouth; caudal bent upwards, with basal lobe. (*Ginglymostomatinæ.*)

"*a.* Teeth in both jaws in many series, each with a strong median cusp, and one or two smaller cusps on each side; nasal cirri present.....GINGLYMOSTOMA, 13.

"** Nostrils not confluent with the mouth; caudal not bent upwards. (*Scylliinæ.*)

"*b.* Nostrils separated by an isthmus; no nasal cirri; tail not serrated.

SCYLLIUM, 13 (*b*).

"**13.—GINGLYMOSTOMA** Müller & Henle." (See page 18.)

"**13** (*b*).—**SCYLLIUM** Cuvier.

"(Cuvier Règne Animal ed. 2, 1829: type *Scyllium catulus* Cuv. = *Squalus stellaris* Gmel.)

"Body rather stout. Head more or less short and broad, the snout low and blunt. Mouth rather large. Teeth small, sharp, tricuspid, in about four rows. Labial fold small or obsolete. Nostrils not confluent with the mouth, separated by a broad isthmus from each other, each with a free flap and no cirrus. Spiracle moderate, close behind the eye. First dorsal beginning over ventrals; second dorsal nearly over anal. Tail slender, not much bent upwards. Spotted. Warmer parts of the Atlantic and Pacific. As here understood, distinguished from *Scylliorhinus* Blainville, 1816 (*S. caniculus* L.), by the separate nasal valves. (*σκύλλιον*, a shark from *σκύλλω*, to tear.)

"* Head very broad and depressed, broader than long. (*Cephaloscyllium*† Gill.)

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* In *Heterodontidæ* the egg-cases are without tentacles and spirally twisted. Except the *Scylliidæ* and *Heterodontidæ*, our sharks are all ovoviviparous.

† Gill, Ann. Lyc. Nat. Hist. N. Y. 1861, 412: type *Scyllium laticeps* Duméril. (*κεφαλή*, head; *σκύλλιον*, Scyllium.)

"**18** (*b*). **S. ventriosum** Garman.—*Swell Shark.*

"Grayish, tinged below with yellowish. Back with black cross-bars, upper parts with large round black spots; sides also with small whitish spots. Head very broad and depressed, broader than long, and not half as deep as broad. Snout very blunt, projecting little beyond the mouth. Mouth very broad, little arched, with only a trace of labial fold. Teeth similar in both jaws, small, tricuspid, in about four series, $\frac{60}{54}$ in number. First dorsal beginning over middle of ventrals; second dorsal beginning behind front of anal and ending before end of anal. When caught, this shark inflates its stomach with air, like the *Tetrodontidæ*, till its diameter is one-third its whole length. It will then float belly upward on the water. L. 2½ feet. Monterey to Chili; very abundant in Santa Barbara Channel. A small, voracious shark, often taken in lobster-pots.

"(Garman, Bull. Mus. Comp. Zoöl. vi, 167: 1880, ? ? *Scyllium laticeps* Aug. Duméril, Rev. et Mag. Zool. 1853, 84, pl. 3, fig. 2: *Cephaloscyllium laticeps* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 40.)"

Page 19, in key, after "*a*", add:

"*y*. Embryo not attached to the uterus by a placenta; teeth all obtuse, without basal cusps ..... MUSTELUS, 14.

"*yy*. Embryo attached to the uterus by a placenta; some of the teeth pointed, each with one or two basal cusps ..... RHINOTRIACIS, 14 (*b*)."

After "*f*" add:

"*z*. First dorsal nearer ventrals than pectorals; embryo not attached to the uterus by a placenta ..... CARCHARINUS, 18.

"*zz*. First dorsal nearer pectorals than ventrals; embryo attached to uterus by a placenta ..... EULAMIA, 18 (*b*)."

After "*ff*" add:

"*fff*. Teeth in upper jaw serrate at base, in lower jaw entire .... HYPOPRION, 19 (*b*)."

Page 20: Erase "20. *Mustelus californicus*", which is doubtless identical with *Mustelus hinnulus*, and add:

"**14** (*b*).—**RHINOTRIACIS** Gill.

"(*Pleuracromylon* Gill, 1864.)

"(Gill, Proc. Ac. Nat. Sci. Phila. 1862, 486: type *Rhinotriacis henlei* Gill.)

"Characters of the genus *Mustelus*, except that each embryo is attached to the uterus by a placenta. The teeth are sharper, some of them being pointed, and with one or more short basal cusps. Warm seas. (ῥίν, snout; τρεῖαχις, Triacis.)

"**20.—R. henlei** Gill."

(See text, "22. T. *henlei*"; coast of California; not uncommon.)

"**20** (*b*). **R. lævis** (Risso) Jordan & Gilbert.

"A small shark resembling *Mustelus hinnulus* and *R. henlei*, but differing from the former in the dentition and in the attachment of the embryo to the uterus by a placenta, and from the latter in the blunter teeth. Only those in the posterior part of the upper jaw have a basal cusp, and these usually but one only. This species is found on the coast of Europe and Africa, and is accredited to our Atlantic fauna by Günther (viii, 386).

"(*Mustelus lævis* Risso, Europe Méridionale, iii, 127: *Mustelus lævis* Günther, viii, 385: *Pleuracromylon lævis* Gill, Proc. Ac. Nat. Sci. Phila. 1864, 148; not of Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 52, = *Rhinotriacis henlei*.)"

Page 21: *Galeorrhinus galeus*, the "Oil Shark", is very abundant on the coast of California, especially southward. Its teeth are coarsely serrated on the outer margin near the base only. *Galeocerdo tigrinus* also ranges northward to San Diego on the Pacific coast.

Pages 22: *Carcharinus glaucus* occurs on the coast of California.

Page 22: Instead of "***" insert:

"**18** (*b*).—**EULAMIA** Gill.

"(Gill, Ann. Lyc. Nat. Hist. N. Y. 1861, 401: type *Carcharias lamia* Risso.)

"Body rather robust, the head broad and depressed; mouth inferior, with the teeth in both jaws strongly serrated in the adult; less so or entire in the young; those in the upper jaw broad, those below narrow, straight, and nearly erect. No spiracles. First dorsal large, placed not far behind pectorals. Pectorals falcate. Second dorsal small. Embryos attached by placentæ to the uterus as in *Scoliodon* and *Rhinotriacis*.* (In *Carcharinus* placentæ are not developed, according to Auguste Duméril, Hist. Nat. des Poiss. i, 244.) Species numerous. (ευ, well; λαμια, Lamia or Lamna, a fabulous monster, from λαιμὸς, devouring hunger.)"

Page 22: The species of "*Eulamia*" should stand as:

"26. *E. obscura* (Le S.) Gill", "27. *E. milberti* (M. & H.) Gill", and "27 (*b*). *E. lamia* (Risso) Gill".

Page 23: Under "*E. lamia*" add:

"**27** (*b*). **E. lamia** (Risso) Gill.—*Bay Shark.*

"Body robust, the back elevated. Head broad and flat; the snout

* So far as known to us, the embryos in all our ovoviviparous sharks except *Eulamia*, *Scoliodon*, and *Rhinotriacis* are without placenta.

long, but wide and rounded, its length from mouth greater than distance between nostrils, which are nearer snout than angle of the mouth. Eye moderate. Teeth $\frac{30}{30}$, their form as in *E. lamia*, the upper regularly triangular, without notch, narrow in the young, the lower narrowly triangular, erect, on a broad base, all the teeth distinctly and evenly serrated. First dorsal beginning at a distance a little less than its own base behind the pectorals, and ending at a point a little more than its own base behind the ventrals. Height of first dorsal two-thirds the depth of the body; pectoral reaching past first dorsal. Second dorsal very small, not one-sixth the height of the first, smaller than anal and nearly opposite it. Tail $3\frac{1}{2}$ in length. Color plain light gray. Warm seas north to San Diego Bay.

"Our specimens differ from descriptions of *E. lamia* in not having the first dorsal higher than the body, and inserted close behind the root of the pectorals. In *E. obscura* and *E. milberti* the upper teeth are deeply notched on the outer margin".

Page 24: After "*Isogomphodon limbatus*" add:

"**19** (*b*).—**HYPOPRION** Müller & Henle.

"(*Hypoprionodon* Gill.)

"(Müller & Henle, Plagiostomen, 1837, 34: type *Carcharias macloti* Müller & Henle.)

"Characters essentially as in *Eulamia*, but with the *lower teeth entire*, the upper teeth coarsely serrated at base only, on one or both sides; lower teeth erect. (ὑπό, below; πρίον, saw; the upper teeth being serrated at base.)

"**28. H. brevirostris** Poey.

"Snout obtuse; teeth of the upper jaw with the base serrate on both sides; pectoral fins moderate. Bluish, fins without black spots. (*Poey.*) West Indies; occasional on our Gulf coast.

"(Poey, Synopsis Pisc. Cubensium, 1868, 451: *Carcharias brevirostris* Günther, viii, 362.)"

Pages 26, 29, 30, 31: *Sphyrna zygæna*, *Lamna cornubica*, *Carcharodon rondeleti*, *Cetorrhinus maximus*, and a species of *Isurus* (probably *I. oxyrrhynchus*) occur on the coast of California.

Page 34: For the key to genera substitute:

"* Gill-openings six on each side ..... HEXANCHUS, 31 (*b.*)
"** Gill-openings seven on each side ..... HEPTRANCHIAS, 32.

"**31** (*b*).—**HEXANCHUS*** Rafinesque.

"(*Notidanus* Cuvier.)

"(Rafinesque, Caratteri di Alcuni Nuovi Generi, etc. 1810, 14: type *Squalus griseus* Linnæus.)

"Branchial apertures *six* on each side; otherwise essentially as in *Heptranchias*. Two species known. (ἕξ, six; αγχος, bend or sinus; for gill-opening.)

"**41** (*b*). **H. corinus** Jordan & Gilbert.—*Shovel-nosed Shark.*

"Color almost black, unspotted; a grayish lateral streak. Head large, broad, depressed and blunt. No median tooth in upper jaw. About six pointed teeth in front of upper jaw, all entire and without basal cusps. Next three teeth with entire edges and a single cusp on the outer margin. Remaining teeth of upper jaw serrate on the inner margin, and with two or more basal cusps on the outer. Median cusp of lower jaw very small. Other teeth with six cusps, the first the largest, the others regularly smaller, the inner edge in the adults serrated. Tail long, twice as long as head, a little less than one-third the total length. Scales on upper edge of tail enlarged. Monterey to Puget's Sound.

"(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 352.)

"**32. HEPTRANCHIAS** Rafinesque.

"(*Notorhynchus* Ayres.)

"(Rafinesque, Caratteri di Alcuni Nuovi Generi, etc. 1810, 13: type *Squalus cinereus* Gmelin.)

"Gill-openings *seven* on each side. Three species known. (ἑπτά, seven; βράγχια, gills. The change of this name to "*Heptanchus*" is hardly justifiable.)

"**42. H. maculatus** (Ayres) Girard.

"Sandy gray, with some round black spots, larger than the pupil, rather sparsely placed. Head rather depressed; the snout broad, rounded; the nostrils near its tip; spiracles large, nearer the gill-opening than the eye; a long furrow at the angle of the mouth. No median

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*The necessities of nomenclature often require the substitution for the name of the typical genus of a family of some less familiar but earlier name, as *Hexanchus* for *Notidanus*, *Carcharias* for *Odontaspis*, *Dasybatus* for *Trygon*, etc. It is probably unnecessary to change well-known family names to accord with these changes. Among our sharks it is perhaps better to retain the old family names *Odontaspididæ*, *Notidanidæ*, *Cestraciontidæ*, instead of *Carchariidæ*, *Hexanchidæ*, and *Heterodontidæ*, as given in the text. The name *Carchariidæ*, used by various authors for the *Galeorrhinidæ*, is ineligible, because the name *Carcharias* rightfully belongs to a genus of another family.

tooth in upper jaw. Two small teeth near together in front, simple and pointed; two a little larger, behind and outside of these, then two others directly behind the first pair. Next, on each side, a tooth much larger, pointed, with a conspicuous cusp on the outer side at base, and one or more denticulations beside. The other teeth are larger, similar, but more serrated and more oblique, approaching the lower teeth in form. The median tooth in the lower jaw is broad, with a small median cusp and two or three larger lateral cusps on each side. The other teeth, 6 on each side, are much broader than high, with about 4–6 sharp outward-directed cusps. The first cusp is longest and bears a small tooth near its base. These teeth are quite similar and increase slightly in size outwards. Tail long, $2\frac{3}{4}$ in total length, the caudal fin mostly below it. Anal small, just behind the small dorsal. Coast of California and northward; common.

"(*Notorhynchus maculatus* Ayres, Proc. Cal. Acad. Nat. Sci. i, 72; not *Notidanus indicus* Cuvier, etc.)"

Page 36, fourth line: After "small" add "or wanting".

Under "*", after "thick", instead of "usually with rayed", etc., read "with two dorsal fins".

Under "**", instead of the text, read: "Tail with one dorsal fin, or none."

Page 38: After "*Rhinobatus productus*" add:

"§ Anterior nasal valve prolonged to the internal angle of the nostrils; snout not elongate. (*Syrrhina** Müller & Henle.)

"**45** (*b*). **R. exasperatus** Jordan & Gilbert.

"Disk rhombic, about as broad as long. The snout prominent, but bluntish at tip, anterior margin of pectorals forming less than a right angle. Eyes rather large. Rostral ridges separate their whole length. Tail stout, depressed, with a narrow lateral fold, upper surface entirely covered with stout, close-set, stellated prickles of different sizes, largest on the bases of the pectorals and smallest on the outer edges of the fins, those on the tip of snout and anterior edge of the pectorals not enlarged. Stout, bluntish, slightly recurved spines present as follows: One at the upper anterior angle of the eye and two behind it; one large one at the middle of the shoulders, in front of which are two others; two series on the shoulders outside the median line, the inner of two, the outer of two to four; a series of about a dozen on the median line of the back and tail; no lateral series on the tail. Sexes similar. Under side covered

* Müller & Henle, Plagiostomen, 113: type *Syrrhina columnæ* M. & H. (σὺν, together; ῥίν, snout.)

with shagreen, made of triangular depressible asperities. Region from the nostrils to the shoulder girdle smooth, except the lower lip. A few other small naked areas below. Upper lip developed. Teeth $\frac{32}{26}$. Color brown, mottled and barred with blackish; a black blotch on hinder part of pectorals below. Tail rather shorter than disk. First dorsal not far behind ventrals. Snout one-fifth the length of disk, twice the interorbital space. San Diego Bay; abundant. Only young specimens known, but it is probably ovoviviparous and therefore not a *Raioid*.

"(*Platyrhina exasperata* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 32: *Zapteryx exasperatus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 53: *Trygonorhina exasperata* Garman, Bull. Mus. Comp. Zoöl. 1880, 170.)

"**45** (*c*). **R. triseriatus** Jordan & Gilbert.

"Disk broad, ovate, broader than long. The snout very bluntly rounded, not projecting, the angle formed by the pectorals anteriorly very obtuse; anterior outline of the pectorals slightly convex, not undulated. Tail very stout, much longer than the disk, its edges with a broad fold, broader than in *R. exasperatus*. Pectoral fins extending almost to the tip of the snout; rostral ridges wide apart, converging, inclosing a triangular area. Eyes small, wide apart, the broad spiracles close behind them. Caudal fin well developed above and below. Dorsals similar, their posterior free margins very convex. Mouth broad, its width nearly equal to its distance from tip of snout, a deep crease passing around it behind, in front of which the lower lip has three folds of skin; upper lip not developed, a fold of skin passing from the angle of the mouth on either side to the inner angle of the nostrils, thence straight across, inclosing a depressed trapezoidal ⏢-shaped area, bound below by the curved outline of the upper jaw. In this are three cross-folds of skin. Teeth $\frac{60}{56}$. Gill-openings narrow. Skin everywhere, above and below, covered with fine shagreen, the prickles coarser on the anterior outer margin of the pectorals (♂), where are two or three rows of retrorse spines. Four strong spines on the tip of the snout, forming a rhombic figure; four or five spines around each eye. A long series of very strong spines along the median line of the back and tail, and a series of similar ones on each side of the tail; a single strong spine on the outer edge of the shoulder-girdle and two between this and the median series. Color light olive brown, without distinct markings. L. 2 feet. Breadth of disk one-tenth more than its length; tail usually half longer than disk; snout two-ninths of length of disk, not half longer than width of interorbital area. Coast of California from Point Concepcion southward; abundant. In spite of its resemblance to the *Raioid*

genus *Platyrrhina*, this species proves to be viviparous. It is, therefore, referred to the *Rhinobatidæ*, the oviparity of *Raiidæ* being the *only* character distinguishing the two families.

"(*Platyrhina triseriata* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 36.)

"**45** (*d*). **R. lentiginosus** Garman.

"Grayish, with small paler spots, uniform below. Outline similar to that of *R. productus*. Snout long and narrow, its ridges close together throughout. Eyes large, twice as large as spiracles. Interorbital space narrow, concave, as wide as nostrils or the interspace between them. Distance between outer angles of nostrils more than half the snout. Mouth straight, its width not quite twice the interorbital space. Dorsal and preocular spines very small; 5 larger spines on tip of snout. Supraocular and scapular spines obsolete. L. 22 inches. Width 3 in length; tail about 2; snout to the mouth $5\frac{3}{4}$. Coast of Florida. (*Garman.*)

"(Garman, Bull. Mus. Comp. Zoöl. 1880, 168.)"

Page 47, genus *Dasyatis*: The following synopsis of the American species of the genus *Dasyatis*, or better *Dasibatis*, has been prepared at our request by Mr. Samuel Garman, of the Museum of Comparative Zoölogy. It was received too late for insertion in the text. We, therefore, place it here in the form in which it was written by its author:

THE AMERICAN SPECIES OF THE GENUS DASIBATIS.*

By Samuel Garman.

Tail more than twice the length of the disk,
  keeled on the top;
    snout acute, pointed; tail very long, round ..... *tuberculata*
    snout not prominent; tail compressed ..... *longa*
  round on the top, compressed, with lateral series of large tubercles;
    snout not prominent; anterior margins slightly sinuous ..... *centrura*
    snout prominent, with a series of long, narrow, depressed tubercles on the middle of the back ..... *lata*
Tail less than twice and more than one and a half times the length of the disk,
  with two expansions;
    disk subcircular; snout prominent ..... *sabina*
    disk quadrangular; snout not prominent ..... *sayi*
  keeled on the top, with an expansion below; with three series of tubercles on the shoulders ..... *hastata*
Tail less than one and a half times the length of the disk,
  with two expansions;
    mouth with five papillæ ..... *brevis*
    mouth with three papillæ ..... *dipterura*

Dasybatus Walbaum, Kleinii Ichthyol. Enod. sive Index rerum, etc. 1793, 35: type *Raja pastinaca* L. This use of the name has precedence of "*Dasyatis*" Raf.

DASIBATIS TUBERCULATA.

Raja tuberculata Lacép. ii, p. 106, pl. 4, fig. 1.
Raja tuberculata Shaw, Gen. Zoöl. v, pt. 2, p. 290, pl. 127.
Trygon gymnura Müll. Erman's Reise um die Erde, p. 25, Taf. 13.
Trygon osteosticta Müll. l. c. p. 25, Taf. 14.
Trygon tuberculata Duméril, Elasmobr. p. 605.
Trygon tuberculata Günther, Cat. viii, p. 480.

Disk quadrangular, a little wider than long. Snout produced, sharp pointed. Anterior and posterior margins nearly straight, the anterior curved near the outer angle to meet the posterior, and the latter curved near the hinder angle to meet the inner. Tail nearly three times the length of the disk, with a slight ridge above and a narrow cutaneous expansion below, roughened with small spines similar to those on the head, bearing a long serrated spine. A row of elongated tubercles on the dorsum and anterior portion of tail and one or more smaller ones on each shoulder. The posterior tubercles of the median row are so much elongated as to resemble the spine. Mouth much undulated, with three papillæ. Teeth small, unequal. Color yellowish to olivaceous brown, darkening with age. The young are without scales or tubercles. As the animal grows older and the tubercles appear a few scattered asperities appear on the head; still later these increase in number and size to such an extent as to cover the head and dorsum with a heavy coat of mail made up of the closely-set flattened scales. The tubercles of the back cease growing as the scales enlarge, and ultimately there is little distinction between them. Usually the tubercle on the middle of the pectoral arch is larger; those on the tail continue to increase in size with age. A young female measures in length of body 9.9, length of tail 28.2, and width of disk 11.6 inches.

Cannavierias, Surinam, Para, Bahia, and Rio Janeiro.

DASIBATIS LONGA.

(Garman, 1880, Bull. Mus. Comp. Zoöl. vi, p. 170.)

Disk quadrangular, about one-sixth wider than long. Margins nearly straight, anterior meeting in a blunt angle on the end of the snout. Outer angles rounded, posterior blunt. Ventrals rounded. Tail more than twice as long as the body, roughened with small asperities, depressed anteriorly, compressed behind the spine, keeled above the compressed portion, with a long, narrow cutaneous expansion on the lower side. Mouth curved with five papillæ. A row of small tubercles behind the head on the shoulder girdle. It is likely that larger specimens are provided with tubercles on back and tail.

Distinguished from *D. lata* by the shape of the snout and disk and the keel on the tail, and from *D. centrura* by the straight margins of the pectorals and the keel.

One specimen secured at Acapulco, Mexico, by Prof. Alexander Agassiz. One light-colored, reddish-brown specimen from Panama by the Hassler Expedition.

Length of body 11.5, tail 28, and width of pectorals 13.8 inches. Length of body of second specimen, 9.3, tail 24.5, and width of pectorals 11.2 inches.

DASIBATIS CENTRURA.

Raja centrura Mitch. Trans. Lit. & Phil. Soc. N. Y. i, p. 479.
Trygon centrura Linsley, Silliman's Am. Jour. Sci. & Arts, 47, 1844, p. 166.
Trygon centrura Gill (name only), Cat. Fish. E. Coast N. Amer. p. 34.

Disk quadrangular, about one-fourth wider than long. Anterior margins sinuous, concave opposite the eyes, convex toward the slightly protuberant snout and rounded outer angles; posterior straighter, a very little convex; inner convex. Hinder angles blunt. Ventrals truncate, with rounded angles. Tail more than twice as long as the body, much compressed, rounded above, with keel and cutaneous expansion below, with one or more strong serrated spines at the termination of the anterior fifth of its length, rough on all sides with spines or tubercles. Till half grown the young are naked; as they approach maturity broad stellate-based, conical-pointed, irregularly-placed bucklers appear on the middle of the hinder part of the back and on the top and sides of the tail. Very large examples have the central portion of the back closely mailed with small flattened tubercles. The bucklers bear more resemblance to those of the *Rajæ*, *radiata* and *clavata* than to the tubercles of *pastinaca*, *hastata*, or *tuberculata*. Mouth arched forward, with five papillæ. Teeth in quincunx, blunt, smooth. Color of back and tail olive brown; light to white below. From *pastinaca*, which this species resembles in shape, it is distinguished by the tubercles, by the length and compression of the tail, and absence of all trace of keel or expansion on its upper side. A young specimen measures from snout to tail 13.8, length of tail 30.5, and width of pectorals 17.5 inches. The largest specimen in the collection has a total length of 10 feet 3 inches. Common south of Cape Cod. Occasionally found northward.

DASIBATIS LATA.

(Garman, 1880, Bull. Mus. Comp. Zoöl. vi, p. 170.)

Disk quadrangular, one-fourth wider than long. Anterior margins nearly straight, forming a very blunt angle at the snout, rounded near

the outer extremities; posterior convex; inner straight a portion of their length. Ventrals truncate, rounded. Snout produced, forming a rounded prominence in front of the margins of the disk. Length from the forehead less than the width of the head. A line joining the wider portions of the disk passes nearer to the head than to the shoulders. Tail more than twice as long as the body, without a trace of keel above; a long narrow expansion below has its origin opposite that of the spine, and terminates in a keel which continues to the extremity, roughened with small tubercles, with an irregular series of broad-based conical tubercles on each side. A pair of large, compressed, erect tubercles stands immediately in front of the caudal spine, and a similar one is placed over the middle of the pelvic arch. These suggest a continuous series in larger specimens. Three larger elongated tubercles, with points directed backward, similar to those of *D. hastata*, occupy the middle of the shoulder girdle. Mouth curved, six (5–6?) papillæ at the bottom behind the teeth; two of these are in the middle in front, where usually there is but one. Color light olive, probably greenish in life, white below. Distinguished from *D. centrura* by the prominent snout, the shape of the tubercles in the middle of the back, and the narrowness of the posterior portion of the disk. Length of body 16, tail 35.3, and width of pectorals 20.5 inches. Sent from the Sandwich Islands by Andrew Garrett.

DASIBATIS SABINA.

Trygon sabina Lesueur, Jour. Acad. Nat. Sci. Phil. iv, p. 109.
Trygon sabina Müll. et Henle, Plagiostomen, p. 163.
Trygon sabina Duméril, Elasmobranch. p. 607.

Disk subcircular. Snout produced, blunt. Anterior margins of the pectorals concave near the snout, becoming convex toward the broadly rounded outer extremities; hinder and inner margins convex. Upper jaw with a deep indentation, receiving a corresponding prominence on the lower. Teeth at the sides of this indentation much larger, resembling the molars of *Heterodontus*. Mouth with five papillæ. Tail less than twice as long as the disk, tapering to a fine point, rough with small prickles similar to those scattered over the head and back, a cutaneous expansion above, and a broader, longer one below. These end nearly opposite each other, the lower extends forward under the spine. With a median row of tubercles on the dorsum and one or a pair on each shoulder. Distinguished from *tuberculata* by the shape of the snout, the rounded pectorals, the shorter tail, the larger teeth, the greater curva-

ture of jaws, the smaller size, and the *two* cutaneous expansions. Of twenty specimens the average proportional length of body and tail is as four and a half to eight. In no case is the tail twice as long as the disk. Color ochraceous brown; ventral surface light. Length of body of an adult male 9.4, length of tail 15, and width of pectorals 10 inches. Common in the rivers of Florida along the Gulf coast. Several specimens in the collection were captured in Lake Monroe, at a distance from the salt water, by Count Pourtalès.

DASIBATIS SAYI.

Raja sayi Lesueur, Jour. Acad. Nat. Sci. Phil. i, p. 42, fig.
Myliobatis sayi DeKay, New York Fauna, Fish. p. 376.
Trygon sayi Müll. et Henle, Plagiostomen, p. 166.
Myliobatis sayi, Storer, Syn. Fish. N. Amer. p. 262.
Trygon sayi, Duméril, Elasmobranch. p. 603.

Disk quadrangular, about one-sixth wider than long, anterior margins nearly straight, posterior and inner borders convex, outer and posterior angles rounded. Snout not protruding beyond the lines of the margins. Ventrals rounded. Tail strong, rather more than one and a half times the length of the disk, with a strong serrated spine, bearing a short, low cutaneous expansion behind the spine on the upper side, and a longer, little wider one below, ending nearly opposite. Upper jaw undulated; lower prominent in the middle. Teeth small, smooth in young and females, sharp in adult males. Three papillæ at the bottom of the mouth, and one at each side. Body and tail naked. Color olive brown in adult, reddish or yellowish in young; lower surface whitish. This species closely resembles the European species *pastinaca*. A comparison of specimens discovers the following differences: in *Sayi* the anterior margins form a more blunt angle at the end of the snout, which is less prominent at the apex, the outer and posterior extremities of the pectorals are rounder, the posterior margins are more convex, the disk is broader toward the ventrals, and the tail is longer; in *pastinaca* the lateral and hinder angles of the pectorals and the lateral angle of the ventrals are marked by blunted corners. A single small rounded tubercle on the middle of the back. There are specimens in the collection from New York, Pensacola, Bahia, and Rio Janeiro. A young female measured from snout to tail 7.1, length of tail 11, and width of pectorals 8.2 inches.

DASIBATIS HASTATA.

Trygon hastata DeKay, New York Fauna, Fish. p. 375, pl. 65, fig. 214 ♀.
Trygon hastata Storer, Syn. Fish. N. Amer. p. 261.
Trygon hastata Duméril, Elasmobranch. p. 592.

Disk quadrangular, about one-fourth wider than long; anterior margins nearly straight, meeting in a blunt angle on the end of the snout, curved near the outer angle to meet the slightly convex posterior margins; inner borders convex; outer and hinder angles rounded. Ventrals almost entirely covered by the pectorals, hinder margins convex. Tail more than one and a half times the length of the disk, low-keeled on the upper side, a long, broad membranous expansion below, roughened with small asperities, one or more serrated spines. Body smooth in young, very old with scattered small asperities. A row of narrow compressed tubercles along the middle of the back and on the base of the tail; the points of these tubercles are depressed and directed backward. On each shoulder, parallel with the median, there is a shorter row, the length of which varies according to the age of the individual. Mouth with three papillæ. Jaws with more curvature than those of *centrura* and less than those of *sabina*. Young without tubercles. Color bluish or olivaceous brown, darker on dorsum and tail, light on lower surface. Measurement of a young specimen: length of disk 8.5, width 10, and length of tail 14 inches. An adult male measured 20 inches across the pectorals and 16 in length of body. The museum contains specimens from Florida, Cuba, Pernambuco, and Rio Janeiro.

DASIBATIS BREVIS.

(Garman, 1880, Bull. Mus. Comp. Zoöl. vi, 171.)

Disk quadrangular, a little wider than long. Anterior margins nearly straight, curved near the outer extremities to meet the convex posteriors, meeting in a blunt angle on the end of the snout. Outer and posterior extremities of pectorals round, without trace of angles. Ventrals broad, truncate, with angles rounded. Tail less than one and a half times the length of the disk, tapering to an acute point, depressed as far as to the spine, thence compressed to the end of the cutaneous fold, and round from this point to the tip, with a short elevated membraneous expansion behind the spine, and a longer and wider one on the lower side, extending below the former and the spine. The expansions have their hinder extremities opposed; they end quite abruptly and are widest near the

termination. Mouth with five papillæ, outer small. Teeth small, blunt. Upper jaw indented in the middle; lower with a prominence in front, Disk naked in the young. Adult specimens have three rows of tubercles on the middle of the back disposed as are those of *D. hastata*. A large specimen from Payta has three large, erect, broad-based tubercles in front of the caudal spine, and the tail rough with smaller ones. The short rows on the shoulders contain from three to four, and probably increase in number with age, as is the case with the closely allied Atlantic coast species. Color light grayish or olivaceous brown, reddish near the edges, white below, with round spots of brownish under the base of the tail. Compared with *D. hastata* this species differs in the shorter tail, rounder extremities of the disk, and the shape and size of the tubercles and membraneous fins. *D. hastata* has no expansion on the top of the tail, and that on the lower side is very long, of moderate width, and tapers gradually. Those of *D. brevis* are comparatively short and broad; they rise gradually and terminate abruptly. From *D. sayi* this species is to be distinguished by the great development of the caudal expansions, their shape and length, and by the tubercles on shoulders and tail. A large female measures in length of body 17, tail 23, and width of pectorals 18 inches. A young male in length of body 8.1, tail 12, and width of pectorals 9.2 inches. Peru.

Dasibatis dipterura.

(Jordan & Gilbert, 1880, Proc. U. S. Nat. Mus. 31.)

Disk rhomboid, slightly broader than long; anterior margins nearly straight forwards, meeting in a very obtuse angle; posterior margins curved; lateral angles rounded. Tail nearly half longer than disk, with a conspicuous cutaneous fold below, and a smaller but evident one above. Upper jaw considerably curved, with a slight convex profuberance in front, which fits into a slight emargination in the lower jaw, which is convex, its outlines corresponding to the curves of the upper jaw. Bands of teeth wider in front than laterally. Inside of mouth, behind the lower jaw, with three fleshy processes. Teeth about $\frac{2}{2}\frac{1}{3}$; about 8 in a cross-series in the upper jaw, and 10 in the lower. Color light brown, somewhat marbled with darker, but without distinct spots; tail blackish; belly white. Skin everywhere perfectly smooth in the young; adult with small tubercles along the back. San Diego, Cal.

Of the nine species enumerated above as belonging to American

waters one has been described from the Sandwich Islands. It is in view of the probability of its occurrence as an occasional visitor on our Western coasts that it is introduced.

As already noticed, in Volume VI, page 172, of the Bulletin of the Museum of Comparative Zoölogy, the species recently described by Dr. Günther, *Trygon brachyurus* and *Trygon reticulatus*, belong to the genus *Potamotrygon*, which includes the peculiar species of the family inhabiting the rivers of South America.

CLASS IV.—PISCES.

(*The True Fishes.*)

Skeleton bony or cartilaginous. Skull with sutures; a lower jaw present; membrane bones developed in connection with the skull; gill-openings a single slit on each side, sometimes confluent; gills attached to bony arches, normally four pairs of them, their outer margins free. Median and paired fins usually developed; a lyriform shoulder-girdle. Exoskeleton various. Ova comparatively small. No "claspers". Brain-differentiated and distinctly developed. Heart developed, divided into an auricle, ventricle, and arterial bulb.

As here understood, this group includes the great majority of recent fishes, and is equivalent to the *Teleostei*, *Ganoidei*, and *Dipnoi* of most recent writers, the *Actinopteri*, *Crossopterygia*, and *Dipnoi* of Professor Cope. Omitting all notice of the *Dipnoi* and the *Crossopterygia*, all the members of which groups are extralimital and confined to the fresh waters of the tropics, it will be convenient to divide the American representatives of the class of *Pisces* into four series or subclasses—*Chondrostei*, *Holostei*, *Physostomi*, and *Physoclisti*, the first and second including most of the *Ganoidei* of Müller, the second and third the *Teleostei*. These groups are evidently of unequal value, the *Physostomi* and the *Physoclisti* being very intimately connected, and the relations of the *Holostei* with the *Physostomi* are probably more intimate than their relations with the other Ganoids, as has been shown by Professor Cope. Nevertheless, these groups exist in nature, and their recognition under one name or another is convenient.

ANALYSIS OF THE SUBCLASSES OF PISCES.

a. Arterial bulb muscular, with numerous valves; optic nerves forming a chiasma; ventral fins abdominal; air-bladder with a duct; tail heterocercal.
(Series GANOIDEI.*)

b. Ventral fin with an entire series of basilar segments; skeleton cartilaginous.
CHONDROSTEI.

bb. Ventral fin with the basilar segments rudimental; skeleton bony..HOLOSTEI.

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* γάνος, splendor; from the enamelled scales.

aa. Arterial bulb with a pair of opposite valves; optic nerves not forming a chiasma. (Series TELEOSTEI.*)

c. Air-bladder (if present) connected by an air-duct with the stomach or œsophagus; ventral fins (if present) abdominal, their basilar segments rudimental, usually without spines; parietal bones usually united. PHYSOSTOMI.

cc. Air-bladder without duct; ventral fins (if present) usually thoracic or jugular, without basilar segments; spines usually present, at least in the dorsal and ventral fins; parietal bones separated by the supraoccipital. PHYSOCLISTI.

ARTIFICIAL KEY TO THE FAMILIES OF PISCES.

The following key is intended simply to facilitate the identification of species. No attempt is made to indicate the natural characters or relations of the families, and only those species of any group which occur within the limits of the United States are taken into consideration.

I.—VENTRAL FINS PRESENT, ABDOMINAL.

* Dorsal fins 2, the anterior chiefly of soft rays, the posterior adipose.
A. Body naked.
B. Head with 4 to 8 long barbels; dorsal and pectoral fins each with a spine. SILURIDÆ, 29.
BB. Head without barbels; fins without spines.
C. Teeth strong; dorsal fin many-rayed ..... ALEPIDOSAURIDÆ, 40.
CC. Teeth minute; dorsal fin short ..... STERNOPTYCHIDÆ, 43.
AA. Body scaly.
D. Teeth broad, incisor-like ..... CHARACINIDÆ, 32.
DD. Teeth (if present) pointed.
E. Margin of upper jaw formed by the premaxillaries alone.
F. Dorsal fin nearly median.
G. Body with phosphorescent spots ..... SCOPELIDÆ, 42.
GG. Body without phosphorescent spots.
H. Head scaly; scales cycloid; teeth cardiform ..... SCOPELIDÆ, 42.
HH. Head naked; scales ctenoid; teeth villiform .. PERCOPSIDÆ, 47.
FF. Dorsal fin posterior; teeth unequal; body elongate .. PARALEPIDÆ, 41.
EE. Margin of upper jaw formed by maxillaries posteriorly.
J. Body with phosphorescent spots; gill-rakers none. CHAULIODONTIDÆ, 44.
JJ. Body without phosphorescent spots; gill-rakers present. SALMONIDÆ, 46.

** Dorsal fin single, preceded by free spines.
K. Body scaleless, naked or with bony plates.
L. Ventral fins I, 1, the spine strong; snout moderate. GASTEROSTEIDÆ, 64.
LL. Ventral fins I, 5, the spine slender; snout prolonged. AULORHYNCHIDÆ, 63.
KK. Body scaly; snout tubular ..... AULOSTOMATIDÆ, 62.

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* τέλεος, perfect; ὀστέον, bone.

*** Dorsal fins 2, the anterior of spines only, the posterior chiefly of soft rays.

M. Pectoral fin with 5 to 8 lowermost rays detached and filamentous ..... POLYNEMIDÆ, 68.

MM. Pectoral fin entire.

N. Snout tubular, bearing the short jaws at the end; body compressed ..... CENTRISCIDÆ, 60.

NN. Snout not tubular.

O. Teeth strong, unequal; lateral line present. SPHYRÆNIDÆ, 67.

OO. Teeth small or wanting; lateral line obsolete.

P. Dorsal spines 4, stout; anal spines 3.. MUGILIDÆ, 65.

PP. Dorsal spines 4 to 8, slender; anal spine single. ATHERINIDÆ, 66.

**** Dorsal fin soft-rayed, followed by a series of detached finlets. SCOMBERESOCIDÆ, 57.

***** Dorsal fin single, of soft rays only or with a single spine.

a. Tail evidently heterocercal.

b. Body naked; snout with a spatulate blade; mouth wide, without barbels. POLYODONTIDÆ, 25.

bb. Body with 5 series of body shields; mouth inferior, toothless, preceded by 4 barbels ..... ACIPENSERIDÆ, 26.

bbb. Body scaly.

c. Scales cycloid; a broad bony gular plate; dorsal fin many-rayed. AMIIDÆ, 28.

cc. Scales ganoid; no gular plate; dorsal fin short ..... LEPIDOSTEIDÆ, 27.

aa. Tail not evidently heterocercal.

d. Body naked.

e. Throat with a long barbel; no caudal filament; mouth large. STOMIATIDÆ, 45.

ee. Throat without barbel; caudal fin with a long filament; mouth small. FISTULARIIDÆ, 61.

eee. Throat without barbel; no caudal filament; gill membranes joined to the isthmus ..... CYPRINIDÆ, 31.

dd. Body scaly.

f. Pectoral fins inserted near the axis of the body; lower pharyngeal bones fully united; lateral line along the sides of the belly .. SCOMBERESOCIDÆ, 57.

ff. Pectoral fins inserted below the axis of the body; lower pharyngeals separate.

g. Vent in front of ventral fins; eyes concealed ..... AMBLYOPSIDÆ, 48.

gg. Vent behind ventral fins; eyes normal.

h. Head scaly, more or less.

i. Upper jaw not protractile, its lateral margin formed by the maxillaries.

j. Teeth cardiform; jaws depressed, prolonged ..... ESOCIDÆ, 51.

jj. Teeth villiform; jaws short ..... UMBRIDÆ, 50.

ii. Upper jaw protractile, its margin formed by premaxillaries alone ..... CYPRINODONTIDÆ, 49.

hh. Head naked.

k. Gill-opening separated by an isthmus; mouth toothless; lower pharyngeals falciform.

l. Dorsal fin with a serrated spine ..... CYPRINIDÆ, 31.

ll. Dorsal fin without serrated spine.

m. Dorsal fin with (usually) less than 10 (developed) rays; pharyngeal teeth few (less than 8). CYPRINIDÆ, 31.

mm. Dorsal fin with (usually) more than 10 rays; pharyngeal teeth numerous.....CATOSTOMIDÆ, 30.

kk. Gill-openings not separated by an isthmus; lower pharyngeal bones not falciform.

n. Throat without barbel; no phosphorescent spots.

o. Lateral line present.

p. Lower jaw with a gular plate; teeth villiform; fins with scaly sheaths.....ELOPIDÆ, 36.

pp. Lower jaw without gular plate.

q. Tongue with canine teeth; maxillary extending beyond eye ....HYODONTIDÆ, 35.

qq. Tongue without canines.

r. Mouth black within; teeth all pointed. ALEPOCEPHALIDÆ, 33

rr. Mouth pale within; teeth on roof and floor of mouth blunt and granular..ALBULIDÆ, 34.

oo. Lateral line obsolete.

s. Lower jaw much shorter than upper.

t. Mouth small, toothless; maxillary not reaching beyond eye..DOROSOMATIDÆ, 38.

tt. Mouth very wide, the maxillary reaching much beyond eye.....ENGRAULIDÆ, 39.

ss. Lower jaw scarcely shorter than upper; maxillary compound.....CLUPEIDÆ, 37.

nn. Throat with a long barbel; sides with phosphorescent spots.....STOMIATIDÆ, 45.

II.—VENTRAL FINS PRESENT, THORACIC OR JUGULAR.

A. Eyes unsymmetrical, both on the same side of the head ....PLEURONECTIDÆ, 123.

AA. Eyes symmetrical.

B. Gill-openings in front of the pectoral fins.

C. Body more or less scaly or armed with bony plates.

D. Ventral fins completely united; gill membranes joined to the isthmus. GOBIIDÆ, 104.

DD. Ventral fins separate.

E. Ventral rays I, 5.

F. Suborbital with a bony stay, which extends across the cheeks to or toward the preopercle; cheeks sometimes entirely mailed.

G. Pectoral fin with 2 or 3 lower rays detached and free. TRIGLIDÆ, 108.

GG. Pectoral fin entire.

H. Slit behind fourth gill small or wanting.

I. Anal spines 3.....SCORPÆNIDÆ, 106.

II. Anal spines obsolete.....COTTIDÆ, 107.

HH. Slit behind fourth gill large .....CHIRIDÆ, 105.

FF. Suborbital stay wanting; cheeks not mailed.

J. Spinous dorsal transformed into a lamellated sucking disk. ECHENEIDIDÆ, 70.

JJ. Spinous dorsal (if present) not transformed into a sucking disk.

K. Dorsal spines all or nearly all disconnected from each other.

L. Body elongate, terete..... .....ELACATIDÆ, 71.

LL. Body oblong or ovate, compressed.

M. Caudal peduncle very slender, the fin widely forked. CARANGIDÆ, 75.

MM. *Caudal peduncle stoutish, the fin little forked.
STROMATEIDÆ, 77.

KK. Dorsal spines (if present) all, or most of them, connected by membrane.

N. Pectoral fin with 4 to 9 lowermost rays detached and filiform.....POLYNEMIDÆ, 68.

NN. Pectoral fin entire.

O. Dorsal and anal with detached finlets.

P. Anal preceded by 2 free spines ....CARANGIDÆ, 75.

PP. Anal not preceded by 2 free spines.
SCOMBRIDÆ, 74.

OO. Dorsal and anal without finlets.

Q. Lateral line armed posteriorly with keeled plates; 2 free anal spines.
CARANGIDÆ, 75.

QQ. Lateral line unarmed.

R. Throat with 2 long barbels (placed just behind chin)..... MULLIDÆ, 95.

RR. Throat without long barbels.

S. Vomer with teeth.

T. Dorsal fin continuous, without distinct spines.

U. Caudal fin deeply forked; no pseudobranchiæ...CORYPHÆNIDÆ, 78.

UU. Caudal fin rounded; pseudobranchiæ present.....ICOSTEIDÆ, 101.

TT. Dorsal fin with a differentiated spinous part.

V. Gill membranes joined to the isthmus; no lateral line... GOBIIDÆ, 104.

VV. Gill membranes free from the isthmus.

W. Eyes lateral.

X. Anal fin preceded by 2 free spines.

–Scales cycloid, minute.
CARANGIDÆ, 75.

––Scales ctenoid, moderate.
POMATOMIDÆ, 76.

XX. Anal fin not preceded by free spines.

Y. Tail keeled.....CARANGIDÆ, 75.

YY. Tail not keeled.

Z. Anal spines none.
SERRANIDÆ, 86.

ZZ. Anal spines 1 or 2.

* Scales large, deciduous; mouth nearly vertical.....APOGONIDÆ, 89.

** Scales smaller, adherent; mouth nearly horizontal.

† Anal rays more than 20 .....POMATOMIDÆ, 76.

†† Anal rays less than 20 .....PERCIDÆ, 85.

ZZZ. Anal spines 3.

‡ Pseudobranchiæ small, glandular, covered by skin.....CENTRARCHIDÆ, 84.

‡‡ Pseudobranchiæ large, exposed.

¶ Front teeth incisor-like, compressed.....SPARIDÆ, 88.

¶¶ Front teeth all pointed; no incisors.

§ Maxillary slipping under preorbital for its whole length.
PRISTIPOMATIDÆ, 87.

§§ Maxillary not slipping under preorbital posteriorly.....SERRANIDÆ, 83.

ZZZZ. Anal spines 4 to 10.

CENTRARCHIDÆ, 84.

WW. Eyes superior; mouth nearly vertical.....URANOSCOPIDÆ, 103.

SS. Vomer without teeth.

a. Tail with a strong spine on each side; teeth incisor-like .. ..TEUTHYDIDÆ, 99.

aa. Tail without spine.

b. Anal preceded by 2 free spines; gill membranes free from isthmus.

CARANGIDÆ, 75.

bb. Anal without free spines.

c. Teeth setiform; soft parts of vertical fins completely scaly; body compressed and elevated; anal spines 3 or 4.

d. Dorsal fin continuous .....CHÆTODONTIDÆ, 98.

dd. Dorsal fin deeply notched.....EPHIPPIDÆ, 97.

cc. Teeth not setiform.

e. Lateral line obsolete.

f. Gill membranes joined to the isthmus .....GOBIIDÆ, 104.

ff. Gill membranes free from the isthmus.....CENTRARCHIDÆ, 84.

ee. Lateral line present.

g. Dorsal fin without distinct spines; no anal spines....ICOSTEIDÆ, 101.

gg. Dorsal fin with distinct spines.

h. Anal spines 1 or 2.

i. Lateral line interrupted; no slit behind fourth gill.

POMACENTRIDÆ, 96.

ii. Lateral line complete, extending to the tip of the caudal fin; head scaly .....SCIÆNIDÆ, 91.

iii. Lateral line complete, extending to the base of the caudal.

j. Upper jaw with posterior canines; dorsal fin continuous.

TRACHINIDÆ, 102.

jj. Upper jaw without canines; dorsal fins 2 .....PERCIDÆ, 85.

hh. Anal spines 3.

i. Anal with more than 15 soft rays.

j. Preopercle entire.....EMBIOTOCIDÆ, 93.

jj. Preopercle serrate .....STROMATEIDÆ, 77.

ii. Anal with less than 15 soft rays.

k. Dorsal spines 9 or 10.

l. Cheeks and opercles scaly.....GERRIDÆ, 92.

ll. Cheeks and opercles chiefly naked .. ..LABRIDÆ, 95.

kk. Dorsal spines 11 to 15.

m. Upper jaw with posterior canines.....LABRIDÆ, 95.

mm. Upper jaw without posterior canines.

* Jaws with incisors or molars, or both .....SPARIDÆ, 88.

** Jaws with pointed teeth only.....PRISTIPOMATIDÆ, 87.

kkk. Dorsal spines 17 or more; anterior teeth canine-like.

LABRIDÆ, 95.

hhh. Anal spines 6.....CICHLIDÆ, 94.

EE. Ventral rays more than I, 5.

n. Caudal fin wanting; scales spinous..MACRURIDÆ, 121.

nn. Caudal fin well developed.

o. Tail isocercal; ventrals jugular .....GADIDÆ, 120.

oo. Tail diphycercal.

p. Ventral rays about 15; dorsal fin single, elevated.

LAMPRIDIDÆ, 80.

pp. Ventral rays about I, 7.

q. Dorsal spines 3 or 4; vent anterior.

APHREDODERIDÆ, 83.

qq. Dorsal spines about 11; vent normal; scales large, very rough.

BERYCIDÆ, 82.

qqq. Dorsal spines about 10; vent normal; scales minute.....ZENIDÆ, 81.

EEE. Ventral fins with or without spine; the number of soft rays less than 5.

r. Dorsal fin composed of spines only.

s. Dorsal fin extremely high.....BRAMIDÆ, 79.

ss. Dorsal fin low.....BLENNIIDÆ, 112.

rr. Dorsal fin of spines anteriorly, of soft rays posteriorly.

t. Pectoral fins entire.

u. Body entirely covered with series of bony plates.....TRIGLIDÆ, 108.

uu. Body not mailed.

v. Suborbital with a bony stay.

COTTIDÆ, 107.

vv. Suborbital without bony stay.

BLENNIIDÆ, 112.

tt. Pectoral fin divided to the base in two unequal parts.....TRIGLIDÆ, 108.

rrr. Dorsal fin of soft rays anteriorly, of low spines posteriorly.....ZOARCIDÆ, 115.

rrrr. Dorsal fin of soft rays only.

w. Dorsal fin very short; body mailed.

TRIGLIDÆ, 108.

ww. Dorsal fin very long; body with small scales.

x. Dorsal and anal joined to the caudal; pseudobranchiæ present.

y. Gill membranes joined to the isthmus.....ZOARCIDÆ, 115.

yy. Gill membranes free from the isthmus.....OPHIDIIDÆ, 118.

xx. Dorsal and anal free from the caudal or nearly so; no pseudobranchiæ.

z. Tail isocercal; chin usually with a barbel.....GADIDÆ, 120.

zz. Tail diphycercal, no barbel.

BROTULIDÆ, 119.

CC. Body scaleless, smooth or armed with tubercles, prickles, or scattered bony plates.

*Breast with a sucking disk.

A. Gill membranes free from the isthmus; no spinous dorsal....GOBIESOCIDÆ, 111.

AA. Gill membranes joined to the isthmus.

B. Skin smooth.....LIPARIDIDÆ, 109.

BB. Skin with tubercles or spines.....CYCLOPTERIDÆ, 110.

** Breast without sucking disk.

C. Ventrals completely united.....GOBIIDÆ, 104.

CC. Ventrals separate.

D. Dorsal and anal fins followed by finlets.
E. Free anal spines 2 ..... CARANGIDÆ, 75.
EE. Free anal spines none ..... SCOMBRIDÆ, 74.
DD. Dorsal and anal without finlets.
F. Upper jaw prolonged into a "sword" ..... XIPHIIDÆ, 72.
FF. Upper jaw not prolonged into a sword.
G. Suborbital with a bony stay ..... COTTIDÆ, 107.
GG. Suborbital without bony stay.
H. Anal fin absent; caudal fin rudimentary or directed upward. TRACHYPTERIDÆ, 100.
HH. Anal fin present; caudal developed.
I. Ventral rays less than I, 5.
J. Dorsal spines none at all; lateral line with prickles. ICOSTEIDÆ, 101.
JJ. Dorsal spines very few (less than 6) ..... BATRACHIDÆ, 114.
JJJ. Dorsal spines numerous ..... BLENNIIDÆ, 112.
II. Ventrals thoracic, I, 5, or more.
K. Dorsal with a series of bony plates at base .... ZENIDÆ, 81.
KK. Dorsal without bony plates at base.
L. Anal preceded by 2 free spines ..... CARANGIDÆ, 75.
LL. Anal without free spines ..... TRACHINIDÆ, 102.

BB. Gill-openings small, behind the pectoral fins, which are more or less pediculate.
M. Gill-openings in or behind upper axil of pectorals; mouth small .... MALTHEIDÆ, 126.
MM. Gill-openings in or behind lower axil; mouth large.
N. Head compressed; no pseudobranchiæ. ANTENNARIIDÆ, 125.
NN. Head depressed; pseudobranchiæ present. LOPHIIDÆ, 124.

III.—VENTRAL FINS ENTIRELY WANTING.

A. Gill-openings ventral, confluent in a longitudinal slit; body eel-shaped. SYNAPHOBRANCHIDÆ, 54.
B. Gill-openings lateral, or not confluent.
C. Gill membranes united to the isthmus (*i. e.*, gill-openings separated by an isthmus).
D. Dorsal fin single, of spines only.
E. Molar teeth present ..... ANARRHICHADIDÆ, 113.
EE. Molar teeth none ..... BLENNIIDÆ, 112.
DD. Dorsal fins two, anterior spinous, posterior soft; teeth incisor-like. BALISTIDÆ, 128.
DDD. Dorsal fin undivided, the spines feeble or none.
E. Snout tubular, bearing the short, toothless mouth at its end; body mailed.
F. Caudal fin present; head in the line of the axis of the body. SYNGNATHIDÆ, 58.
FF. Caudal fin wanting; head not in line of axis of body. HIPPOCAMPIDÆ, 59.

EE. Snout not tubular.
G. Body elongate, eel-shaped.
H. Pectoral fins wanting.
I. Gill-openings very small ..... MURÆNIDÆ, 52.
II. Gill-openings moderate ..... ANGUILLIDÆ, 53.
HH. Pectoral fins present.

J. Jaws attenuate, forming a long, snipe-like beak.
NEMICHTHYIDÆ, 56.

JJ. Jaws not attenuate.
K. Tail tapering into a filament.....SACCOPHARYNGIDÆ, 54.
KK. Tail not filamentous.
M. Maxillaries and premaxillaries distinct....ZOARCIDÆ, 115.
MM. Maxillaries and premaxillaries more or less coalescent with vomer and palatines.
ANGUILLIDÆ, 53.

GG. Body not eel-shaped.
N. Breast with a sucking disk.
O. Skin smooth.....LIPARIDIDÆ, 109.
OO. Skin tubercular.....CYCLOPTERIDÆ, 110.
NN. Breast without sucking disk.
P. Teeth in each jaw confluent into one.
Q. Body compressed, rough....ORTHAGORISCIDÆ, 131.
QQ. Body not compressed, spinous..DIODONTIDÆ, 130.
PP. Teeth in each jaw confluent into two.
TETRODONTIDÆ, 129.
PPP. Teeth separate.
R. Body enveloped in a bony box...OSTRACIIDÆ, 127.
RR. Body not mailed..... STROMATEIDÆ, 77.

CC. Gill membranes free from the isthmus.
S. Vent at the throat.
T. Vertical fins confluent; body eel-shaped.
FIERASFERIDÆ, 117.
TT. Vertical fins separate; body oblong.
AMBLYOPSIDÆ, 48.

SS. Vent posterior.
U. Caudal fin wanting; body naked.
TRICHIURIDÆ, 73.
UU. Caudal fin present.
V. Upper jaw prolonged into a sword.
XIPHIIDÆ, 72.
VV. Upper jaw not prolonged into a sword.
W. Body ovate, much compressed.
STROMATEIDÆ, 77.
WW. Body oblong or elongate.
X. Gill membranes broadly united; teeth present.
Y. Dorsal fin of spines only.
BLENNIIDÆ, 112.
YY. Dorsal fin of soft rays only.
CONGROGADIDÆ, 116.
YYY. Dorsal fins 2, anterior spinous, posterior soft ....COTTIDÆ, 107.
XX. Gill membranes separate.
Z. Jaws toothless, the lower jaw projecting....AMMODYTIDÆ, 69.
ZZ. Jaws with teeth, lower not projecting....OPHIDIIDÆ, 118.

Subclass CHONDROSTEI.

(*The Sturgeons.*)

Skeleton partly cartilaginous. Ventral fin abdominal, with an entire series of basilar segments. No suboperculum or preoperculum. Branchiostegals (single or) wanting; a præcoracoid arch; no symplectic bone. Mesopterygium distinct; interclavicles present.* Arterial bulb with several pairs of valves. Optic nerves forming a chiasma. Intestine with a spiral valve. Air-bladder connected by a duct with the œsophagus. Tail heterocercal, its fin with fulcra. Skin naked or armed with bony plates. This group comprises two orders.

(Order *Chondrostei* Günther, viii, 332–347. *χόνδρος*, cartilage; *ὀστέον*, bone.)

ANALYSIS OF ORDERS OF CHONDROSTEI.

* Maxillary and interopercle obsolete; skin naked; branchihyals cartilaginous; air-bladder cellular ..... Selachostomi, G.

** Maxillary and interopercle present; skin with bony shields; branchihyals osseous; air-bladder simple ..... Glaniostomi, H.

Order G.—SELACHOSTOMI.

(*The Paddle-fishes.*)

A præcoracoid arch; no symplectic bone; premaxillary forming mouth border; no suboperculum, preoperculum, nor interoperculum; mesopterygium distinct; basihyals and superior ceratohyal not ossified; interclavicles present; maxillaries obsolete; branchihyals cartilaginous. This order contains but one family, *Polyodontidæ*. (*σελάχη*, shark; *στόμα*, mouth.)

Family XXV.—POLYODONTIDÆ.

(*The Paddle-fishes.*)

Body fusiform, little compressed, covered with mostly smooth skin. Snout prolonged, expanded into a thin, flat blade, the inner portion formed by the produced nasal bones, the outer portion with a reticulate bony frame-work, the whole somewhat flexible. Mouth broad, terminal, but overhung by the spatulate snout, its border formed by the premaxillaries, the maxillaries being obsolete. Jaws with many fine decid-

* The osteological characters here and elsewhere in this work are mostly taken from Cope's "Contribution to the Ichthyology of the Lesser Antilles". Trans. Am. Phil. Soc. 1870.

uous teeth. Similar teeth on the palatines. No tongue. Spiracles present. Operculum rudimentary, its skin produced behind into a long, acute flap. No pseudobranchiæ nor opercular gill. Gills 4½. Gill-rakers long, in a double series on each arch, the series divided by a broad membrane. Gill membranes considerably connected, free from the isthmus. A single broad branchiostegal. No barbels. Nostrils double, at base of blade. Lateral line continuous, its lower margin with short branches. Dorsal fin well back, of soft rays only. Anal similar, rather farther back. Tail heterocercal, the lower caudal lobe well developed, so that the fin is nearly equally forked. Sides of the bent portion of the tail armed with small rhombic plates. Caudal fin with fulcra. Pectorals moderate, placed low. Ventrals abdominal, many-rayed. Air-bladder cellular, not bifid. Pyloric cœca in the form of a short, broad, branching, leaf-like organ. Intestine with a spiral valve.

Two genera known, *Polyodon* and *Psephurus*, each of one species. Singular fishes, inhabiting the fresh waters of the United States and China. They feed chiefly on mud and minute organisms contained in it, stirring it up with the spatulate snout.

(*Polyodontidæ* Günther, viii, 346–347.)

* Gill-rakers very fine and numerous; caudal fulcra small and numerous.

46.—POLYODON Lacépède.

Paddle-fishes.

(*Spatularia* Shaw: *Platirostra* Le Sueur.)

Lacépède, Hist. Nat. Poiss. i, 402, 1798: type "*Polyodon feuille*" = *P. folium* Bloch.)

Gill-rakers exceedingly numerous, very slender; spatula broad. Caudal fulcra 13 to 20 in number, of moderate size. Rivers of the United States. (πολὺς, many; ὀδὼν, tooth.)

73. P. spathula (Walb.) J. & G.—*Paddle-fish; Spoon-bill Cat; Duck-bill Cat.*

Color olivaceous, rather pale. Opercular flap very long, nearly reaching to ventrals. Spatula broad. Premaxillary extending far behind the small eye. Skin smooth, or nearly so, except the rhombic plates on the sides of the tail. Ventrals near the middle of the body; dorsal well behind them; anal mostly behind the dorsal, and somewhat larger; these fins somewhat falcate. Fin-rays slender. Spiracle with a minute barbel. Isthmus papillose in the young. Spatula 2½ to 4 times in length. Whole head, with opercular flap, more than half length. Head, without spatula or flap, about 5. D. 50–60; A. 50–65; V. 45.

L. 5–6 feet. Mississippi Valley and rivers of the Southern States; generally abundant.

(*Squalus spathula* Walbaum, Artedi Pisc. 1792, 522: "*Polyodon feuille*" Lacépède, Hist. Nat. Poiss. i, 402: *P. folium* Schneider ed. Bloch, Syst. Ichth. 457: *Spatularia reticulata* Shaw, Gen. Zoöl. 1804, v, 362: *Platirostra edentula* (adult) Le Sueur, Journ. Acad. Nat. Sci. Phila. 227: *P. folium* Günther, 346.)

Order H.—GLANIOSTOMI.

(*The Sturgeons.*)

A præcoracoid arch. No symplectic bone. Maxillary present. No suboperculum or preoperculum. Interoperculum present. Mesopterygium distinct. Interclavicles present. Basihyals and superior ceratohyal not ossified. Branchihyals osseous. This group is composed of the single family *Acipenseridæ*. (γλανις, a cat-fish, Silurus; στόμα, mouth.)

Family XXVI.—ACIPENSERIDÆ.

(*The Sturgeons.*)

Body elongate, subcylindrical, armed with five rows of bony bucklers, each with a median carina which terminates in a spine. A median dorsal series, and a lateral and abdominal series on each side, the abdominal series sometimes deciduous. Between these the skin is rough, with small irregular plates. Snout produced, depressed, conical or subspatulate. Mouth small, inferior, protractile, with thickened lips. No teeth. Four barbels in a transverse series on the lower side of the snout in front of the mouth. Eyes small; nostrils large, double, in front of eye. Gills 4. An accessory opercular gill. Gill membranes united to the isthmus. No branchiostegals. Maxillary bone distinct from the premaxillary. Head covered with bony plates united by sutures. Fin-rays slender, all articulated. Vertical fins with fulcra. Pectorals placed low. Ventrals many-rayed, behind middle of body. Dorsal placed posteriorly. Anal somewhat behind it, similar. Tail heterocercal, the lower caudal lobe developed. Air-bladder large, simple, connected with the œsophagus. Pseudobranchiæ small or obsolete. Stomach without blind sac. Rectum with a spiral valve. Pancreas divided into pyloric appendages.

Large fishes of the seas and fresh waters of northern regions. Most of the species are migratory, like the salmon, which are found in the same waters. Genera 2, species about 20, although more than five times that number have been described. The American species especi-

ally have been unduly multiplied, particularly by Auguste Duméril, who has found upwards of forty of them in the museum at Paris. The actual number of American sturgeons does not exceed 7, and is more likely still less. The changes with age are considerable; the snout in particular becomes much shorter and less acute, and the roughness of the scales is greatly diminished; the ventral shields sometimes disappear altogether. The number of plates, although one of the best specific characters, is subject to considerable variations.

(*Acipenseridæ* Günther, viii, 332–345.)

* Spiracles present; snout subconic; rows of bony shields distinct throughout.
ACIPENSER, 47.

** Spiracles obsolete; snout subspatulate; rows of bony shields confluent on the tail.
SCAPHIRRHYNCHOPS, 48.

47.—ACIPENSER* Linnæus.

Sturgeons.

(Artedi, Linn. Syst. Nat.: type *Acipenser sturio* L.)

Snout subconical, more or less depressed below the level of the forehead. A small spiracle over the eye. Caudal peduncle moderately long, deeper than broad, the rows of bony bucklers distinct to the base of the caudal fin. Tail not produced into a filament, its tip surrounded by the caudal rays. Gill-rakers small, narrowed or lanceolate. Pseudobranchiæ present. Species numerous. (Latin *acipenser*, a sturgeon; from ἄχις, point; πεντα, five?)

74. A. sturio L.—*Common Sturgeon.*

Snout rather sharp, nearly as long as the rest of the head, becoming comparatively shorter and blunter with age. Barbels nearly midway between mouth and tip of snout, shortish, not reaching the mouth. Gill-rakers small, slender, pointed, sparse, not longer than the pupil.

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* M. Duméril (Hist. Nat. Poiss. ii, 89) divides this group into six subgenera, as follows:

a. Spines of dorsal shields situated near their middle. (*Mesocentres.*)
  b. Stellate plates none.
    c. Scutella (between large shields) disposed without order ..... HUSO.
    cc. Scutella disposed in quincunx ..... ACIPENSER.
  bb. Stellate plates numerous ..... ANTACEUS.
aa. Spines of dorsal shield at the posterior extremity. (*Opisthocentres.*)
    d. Stellate plates none.
      e. Lip emarginate ..... STERLETUS.
      ee. Lip entire ..... LIONISCUS.
    dd. Stellate plates numerous ..... HELOPS.

The same species at different ages may frequently belong to two or more of these subgenera.

Fulera roughish, not enlarged. Lower lobe of tail rather sharp. Sides of tail with regular rhombic plates. Plates mesocentrous, rather rough. Anal smaller than dorsal, placed mostly below it. Anterior rays of pectoral thickened. "Skin with very small rough points in very young examples; in older ones these ossifications are broader, rough, substellate, and more or less regularly arranged in oblique series." D. 40–44; A. 26–30. Dorsal plates 11–14; lateral 27–36; ventral plates 11. Atlantic Ocean; ascending rivers of Europe and North America.

Var. **oxyrrhynchus** (Mitchill), the American Sturgeon, has the number of lateral plates generally fewer—27–29 instead of 29–36, as in European examples. The stellate ossifications are also said to be somewhat rougher than in the European form. Massachusetts to Florida; abundant.

(L. Syst. Nat.; Günther, viii, 342: *Acipenser oxyrhynchus* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 462, and of most American writers.)

75. A. transmontanus Richardson.—*White Sturgeon; Columbia River Sturgeon; Sacramento Sturgeon.*

Color dark grayish, scarcely olive-tinged, and without stripes. Dorsal shields mesocentrous, with a compressed bluntish spine, which is anteriorly often serrated, and followed behind by a compressed keel. Lateral shields rather opisthocentrous. Skin with stellate roughnesses, but smoother than in *A. medirostris*. Snout sharp in the young, becoming rather blunt and short in the adult, when it is considerably shorter than the rest of the head. Barbels rather nearer to the tip of snout than to the mouth. Gill-rakers comparatively long, more than 3 times as high as broad, about 26 in number. Upper lobe of tail with rhombic plates. First caudal fulcrum, above and below, enlarged and granular. Lower lobe of caudal rather sharp and long, not much shorter than upper. Dorsal plates 12; lateral 36–49, usually about 44; ventral 10. Anal fin mostly below dorsal. D. 45; A. 28. Depth 7 in length; head 4. Pacific coast, south to Monterey, ascending the Sacramento, Columbia, and Fraser's Rivers in large numbers in spring. Reaches a weight of 300 to 600 pounds, and is used as food.

(Richardson, Fauna Bor.-Amer. iii, 278, 1836: *Acipenser brachyrhynchus* and *acutirostris* (young) Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 15, 16: *Acipenser transmontanus* and *brachyrhynchus* Günther, viii, 336, 337.)

76. A. medirostris Ayres.—*Green Sturgeon.*

Color olive-green, with an olive stripe on the median line of the belly and one on each side above the ventral plates, these stripes ceasing opposite the vent. Shields generally opisthocentrous, with a strongly

hooked spine. Skin very rough. Snout about as in *A. transmontanus*, sharp in the young, becoming blunt with age, usually rather shorter than the rest of head. Barbels nearly midway between snout and mouth. Gill-rakers scarcely higher than broad, about 17 in number. Upper lobe of tail with some scattered plates. Caudal fulcra not enlarged. Lower lobe of caudal short and blunt, little more than half the length of the upper. Dorsal plates 10; lateral 28–30; ventral 9. Anal fin about half below the dorsal. D. 37; A. 30. Depth $7\frac{1}{2}$ in length; head $4\frac{1}{4}$. Pacific coast, ascending the rivers from San Francisco northward, reaching a large size. Less abundant than *A. transmontanus;* not used for food, being reputed poisonous.

(Ayres, Proc. Cal. Acad. Nat. Sci. i, 15; Günther, viii, 342: *Acipenser agassizi* Günther, viii, 344: *Acipenser acutirostris* Günther, viii, 344; not of Ayres.)

77. A. rubicundus Le Sueur.—*Lake Sturgeon; Ohio Sturgeon; Black Sturgeon; Stone Sturgeon; Rock Sturgeon.*

Blackish above, sides paler or reddish. Body comparatively elongate; snout slender and long in the young, becoming quite blunt with age, when it is considerably shorter than the rest of the head; shields large, rough with strongly hooked spines, becoming later comparatively smooth. Skin with minute rough plates. Ventral shields growing smaller with age, and finally deciduous. Dorsal shields 13 (11–16); lateral shields (34) 30–39; ventral plates 8–10. D. 35; A. 26. L. 6 feet. Weight 50 to 100 pounds. Mississippi Valley, Great Lakes, and northward. Our common fresh-water sturgeon, usually not descending to the sea.

(Le Sueur, Trans. Amer. Phil. Soc. i, 1818, 388: *Acipenser maculosus* Le Sueur, Trans. Amer. Phil. Soc. i, 393: *Acipenser rupertianus* Richardson, Fauna Bor.-Amer. iii, 311: *Acipenser carbonarius, lævis,* and *rhynchæus* Agassiz, Lake Superior, 271, 276: *Acipenser rubicundus, maculosus,* and *liopeltis* Günther, viii, 338, 339, 341; Milner, Rept. U. S. Fish Com. 1872–'73, 67.)

78. A. brevirostris Le Sueur.—*Short-nosed Sturgeon.*

"Snout very short and obtuse, about one-fourth of the length of the head. Barbels short, simple. Osseous shields rather small and distant from one another, finely radiated and granulated; 8–10 on the back, 22–28 on the sides, 6–8 along the abdomen. Skin very sparingly covered with minute prickles and very small scattered ossifications. The greater part of the anal below the dorsal. D. 30." (*Günther.*) Cape Cod to Florida.

(Le Sueur, Trans. Amer. Phil. Soc. i, 390; Günther, viii, 341.)

48.—SCAPHIRRHYNCHOPS Gill.

Shovel-nose Sturgeons.

(*Scaphirhynchus* Heckel, Ann. Wiener Mus. Naturgesch. i, 1835, 71; preoccupied in ornithology.)

(*Scaphirhynchops** (Gill, MSS.) Jordan & Copeland, Bull. Buff. Soc. Nat. Hist. 1876, 161; type *Acipenser platorynchus* Rafinesque.)

Snout broad, depressed, subspatulate or shovel-shaped. No spiracle. Caudal peduncle very long, strongly depressed, broader than deep. Rows of bony bucklers confluent below the dorsal fin, forming a complete coat of mail on the tail. Tail produced in a filament beyond the caudal fin. Gill-rakers somewhat fan-shaped. Pseudobranchiæ obsolete. Species about 4, inhabiting the fresh waters of the United States and Central and Eastern Asia. (σκάφη, spade; ῥύγχος, snout; ὄψ, appearance.)

79. S. platyrrhynchus (Rafinesque) Gill.—*Shovel-nosed Sturgeon; White Sturgeon.*

Body elongate, tapering into a slender, depressed tail, which extends beyond the caudal fin in the form of a filament. This filament is long and slender in the young, but is frequently lost in the adult. Bony shields opisthocentrous, sharply keeled, the series confluent below the dorsal, obliterating the smaller plates between. Two occipital plates with short keels. A spine in front of eye, and one at the posterior edge of the rostral "shovel"; snout in the young with a few spines. Barbels nearer mouth than tip of snout. Greatest width of head about half its length. None of the fulcra enlarged. Dorsal and anal small. Anal partly below dorsal. Gill-rakers small, lamellate, somewhat fan-shaped, ending in 3–4 points. Dorsal shields 15–18; lateral 41–46; ventral 11–13. Head 4 in length. L. 5 feet. Mississippi Valley and streams of the Western and Southern States; common.

(*Acipenser platorhynchus* Rafinesque, Ichth. Oh. 1820, 80: *Scaphirhynchus rafinesquei* Heckel, Ann. Wiener Mus. Naturgesch. i, 1835, 71: *Scaphirhynchus cataphractus* Günther, viii, 345.)

SUBCLASS HOLOSTEI.

(*The Bony Ganoids.*)

Skeleton bony. Ventral fin abdominal, with the basilar segments rudimentary, as in ordinary fishes. Primary radii of posterior limb generally reduced to one rudiment. Suboperculum and preoperculum present.

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* "In words beginning with ῥ, ῥ is doubled after a prefix" (*Liddell & Scott*, Gr.-Engl. Lex. 1858, 213); hence *Scaphirrhynchops*, *Hemirrhamphus*, and all similar words are properly written with the double *r*.

Branchiostegals present. Coronoid bone and præcoracoid arch present. Arterial bulb with several pairs of valves. Optic nerves forming a chiasma. Intestine with a spiral valve. Air-bladder cellular, lung-like, connected by a sort of glottis with the œsophagus. Tail heterocercal. Skin covered with scales, which are ganoid or cycloid. As here understood, this group consists of the two orders *Ginglymodi* and *Halecomorphi*, the *Crossopterygia* being considered as forming a distinct subclass. The *Chondrostei*, *Holostei*, and *Crossopterygia* form the series or subclass *Ganoidei*, represented by five widely divergent families among recent fishes and by a great variety of extinct types. These forms, so far as known, agree in a number of respects already indicated, and differ from all the *Teleostei*, or ordinary fishes, in the presence of several pairs of valves in the arterial bulb, and in the presence of the optic chiasma. The relations of the *Halecomorphi* with the Teleostean order of *Isospondyli* are, however, undoubtedly very close.

(*Ganoidei Holostei* part Günther, viii, 324-325, 328-331. *ὅλος*, complete; *ὀστέον*, bone.)

ANALYSIS OF ORDERS OF HOLOSTEI.

* Vertebræ opisthocœlian; maxillary bone transversely divided into several pieces.
GINGLYMODI, I.

** Vertebræ amphicœlian; maxillary bone not transversely divided.
HALECOMORPHI, J.

ORDER I.—GINGLYMODI.

(*The Gar Pikes.*)

Parietals in contact. Pterotic, basis cranii, and anterior vertebræ simple. Symplectics present. Mandible with opercular, coronoid, angular, articular, and dentary bones. Third superior pharyngeal small, lying on fourth. Upper basihyal wanting. Maxillary transversely divided. A cartilaginous præcoracoid arch. Vertebræ opisthocœlian. Pectoral fins with mesopterygium and five other basal elements. Tail heterocercal. This order includes the single family *Lepidosteidæ*. (*γιγγλυμὸς*, hinge; *ὀδοὺς*, tooth.

FAMILY XXVII.—LEPIDOSTEIDÆ.

(*The Gar Pikes.*)

Body elongate, subcylindrical, covered with hard, rhombic, ganoid scales or plates, which are imbricated in oblique series running downward and backward. Both jaws more or less elongate, spatulate or beak-like, the upper jaw projecting beyond the lower. Premaxillary

forming most of the margin of the upper jaw; the maxillary transversely divided into several pieces. Lower jaw composed of as many pieces as in reptiles. Coronoid present. Both jaws with an outer series of small teeth, followed by one (or two) series of large teeth, besides which on the jaws, vomer, and palatines are series of small, close-set, rasp-like teeth. Tongue toothless. Large teeth of the jaws conical in form, pointed and striate, placed at right angles to the jaw. These large teeth rest, according to Agassiz, in a rather deep furrow, protected on the outside by the raised border of the jaw, and on the inside by a ridge of the same nature. These teeth are pierced in the centre by a foramen, which communicates with the maxillary canal, and through which the nerves and blood vessels enter the pulp cavity of the tooth. The forms of the folded layers of dentine within the teeth are peculiar. Pharyngeals with rasp-like teeth. Tongue short, broad, emarginate, free at tip. External bones of skull very hard and rugose. Eyes small. Nostrils near the end of the upper jaw. An accessory gill on the inner side of the opercle. Pseudobranchiæ present. No spiracles. Gills four, a slit behind the fourth. Branchiostegals 3. Gill membranes somewhat connected, free from the isthmus. Gill-rakers very short. Air-bladder cellular, lung-like, somewhat functional, communicating by a glottis with the œsophagus. Fins with fulcra. Dorsal fin short, rather high, posterior, nearly opposite the anal, which is similar in form. Tail heterocercal, in the young produced as a filament beyond the caudal fin. Caudal convex. Ventrals nearly midway between pectorals and anal. Pectoral and ventrals moderate, few-rayed. Vertebræ with ball-and-socket joints (*opisthocœlian*). Stomach not cœcal. Pyloric appendages numerous. Spiral valve of intestines rudimentary. Fishes of the fresh waters of North America. Genera 1 or 2; species probably 3 or 4, although more than 40 have been described. These fishes are of much interest to geologists from their relationship to extinct Ganoid types.

(*Lepidosteidæ* Günther, viii, 328, 331.)

* Large teeth of the upper jaw in a single series (in adult).....LEPIDOSTEUS, 49.

** Large teeth of upper jaw in two series.....LITHOLEPIS, 50.

49.—LEPIDOSTEUS Lacépède.

Gar Pikes.

(*Lepisosteus* Lacépède, Hist. Nat. Poiss. v, 331, 1803: type *Lepisosteus gavialis* Lac. = *Esox osseus* L.)

This genus is characterized by the presence of but one row of large teeth in each jaw. There are in the upper jaw, first, the outer series of

small, sharp, even teeth, then the series of large teeth, some of the anterior teeth being usually movable. Next comes a series of fine teeth, in one row in front, becoming a band behind. Then the vomerine teeth also in a long band, and posteriorly outside of the vomerine band a palatine band. These bands on the roof of the mouth are frequently somewhat confluent or irregular. In young specimens some of the palatine teeth are often enlarged, sometimes forming a regular series. Lower jaw with an outer series of small teeth, then a series of large teeth, then a broad band of fine teeth on each side. No teeth on tongue. Each of the large teeth fitting into a depression in the opposite jaw. Waters of the United States. (λεπὶς, scale; ὀστέον, bone.)

* Beak long and slender; the snout more than twice the length of the rest of the head. (*Lepidosteus.*)

80. L. osseus (L.) Agassiz.—*Long-nosed Gar; Bill-fish; Common Gar Pike.*

Olivaceous, pale and somewhat silvery below. Vertical fins and posterior part of the body with round black spots, which are more distinct in the young. Very young with a blackish lateral band. Snout a little more than twice the length of the rest of the head, its length 15–20 times its least width. Head 3 in length; depth 12. D. 8; A. 9.; V. 6; P. 10; Lat. l. about 62. L. about 5 feet. Great Lakes and rivers of the United States from Vermont to the Rio Grande; generally abundant.*

(*Esox osseus* Linn. Syst. Nat.: *Lepisosteus oxyurus* Raf. Ichth. Oh. 73: *Lepisosteus huronensis* Richardson, Fauna Bor.-Amer. iii, 237; Günther, viii, 330.)

** Beak shorter and broader, little longer than the rest of the head. (*Cylindrosteus*† Rafinesque.)

81. L. platystomus Raf.—*Short-nosed Gar.*

Colors of *L. osseus* or rather darker. Snout usually about one-third longer than the rest of the head, sometimes about equal to it, its length 5–6 times its least width. Head $3\frac{1}{2}$ in length; depth 8. D. 8; A. 8; V. 6; Lat. l. about 56. L. 2–3 feet. Great Lakes and southern and western rivers, with the preceding, but less abundant northward.

(*Lepisosteus platostomus* Rafinesque, Ichth. Oh. 72; Günther, viii, 329.)

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* M. Auguste Duméril (Hist. Nat. Poiss.) divides this species, as represented in the Museum at Paris, into *seventeen*, which are distinguished by trifling differences in proportions and numbers of scales. It is seldom safe to found either a species or a genus of fishes on differences in proportions alone.

† Rafinesque, Ichth. Oh. 1820, 72: type *Lepisosteus platostomus* Raf. (κυλινδρος, cylinder; ὀστεόν, bone.)

50.—LITHOLEPIS Rafinesque.

Alligator Gars.

(*Atractosteus* Rafinesque, 1820.)

(Rafinesque, Amer. Month. Mag. iii, 447, 1818: type *Litholepis adamantinus* Raf.)

This genus is scarcely distinct from *Lepidosteus*, differing only in the presence of a second series of large teeth in the upper jaw, along the outer margin of the palatine bones, at their junction with the premaxillaries. Probably but one species, in the warmer parts of the United States, and southward to Cuba and Central America. (λίθος, stone; λεπὶς, scale.)

82. L. tristœchus (Bloch & Schneider) Jordan & Gilbert.—*Alligator Gar.*

Color greenish, paler below, the adult usually not spotted. Snout usually not quite so long as the rest of the head, its least width contained 3½ times in its length. Head 3½ in length. D. 8; A. 8; V. 6; Lat. l. 60. Scales in an oblique series from the ventrals to middle of back 18–20. L. 8–10 feet. Rivers of the Southern States, Cuba, Mexico, and Central America; reaching a great size.

(?? *Esox viridis* Gmelin ed. Linné, i, 1380: *Esox tristœchus* Schneider ed. Bloch, 395: *Lepisosteus spatula* Lacép. v, 333: *Lepisosteus* or *Atractosteus ferox* Rafinesque, Ichth. Oh. 73: *Lepidosteus manjuari* Poey, Mém. Cuba, i, 273: ? *Atractosteus tropicus* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 172: *Lepidosteus viridis* Günther, viii, 329.)

Order J.—HALECOMORPHI.

(*The Amias.*)

Parietals in contact. Pterotic, basis cranii, and anterior vertebræ simple. Mandible with opercular and coronoid. Maxillary not transversely segmented, bordering the mouth. Third superior pharyngeal lying on enlarged fourth. Upper basihyal wanting. Vertebræ amphicœlian. Pectoral fins with mesopterygium and eight other elements.

This order includes only the family of *Amiidæ*. (Latin *halecomorphus*, formed like a shad; in allusion to the resemblance between this group of Ganoids and the *Isospondyli*.)

Family XXVIII.—AMIIDÆ.

(*The Mud-fishes.*)

Body oblong, compressed behind, terete anteriorly. Head subconical, anteriorly bluntish, slightly depressed, its superficial bones corrugated

and very hard, scarcely covered by skin. Snout short, rounded. Lateral margins of upper jaw formed by the maxillaries, which are divided by a longitudinal suture. Jaws nearly even in front. Cleft of the mouth nearly horizontal, extending beyond the small eye. Lower jaw broad, U-shaped, the rami well separated. Between them a broad bony plate, with radiating striæ, its posterior edge free. Jaws each with an outer series of conical teeth, behind which in the lower is a band of rasp-like teeth. Bands of small teeth on the vomer and pterygoids. Palatines with a series of larger, pointed teeth. Premaxillaries not protractile. Tongue thick, scarcely free at tip. Nostrils well separated, the anterior with a short barbel. Suborbital very narrow. A bony plate covering the cheek, similar to the plates on the top of the head. Operculum with a broad dermal border. Branchiostegals 10–12. No pseudobranchiæ nor opercular gill. No spiracle. Gills 4, a slit behind the fourth. Gill membranes not connected, free from the isthmus. Two peculiar, long, lanceolate, obliquely striate appendages on each side of the isthmus, projecting backward and covered by the branchiostegal rays, the anterior wholly adnate to the isthmus, the posterior free behind.* Isthmus scaleless. Gill-rakers stoutish, very short. Scales of moderate size, rather firm, cycloid, with a membranaceous border. Lateral line present. Dorsal fin long and low, nearly uniform; the posterior rays not much higher than the others; its insertion in front of the middle line of the body, opposite the end of the pectoral. Tail somewhat heterocercal (more so in the young), convex behind. No fulcra. Anal fin short and low. Pectoral and ventral fins short and rounded, the ventrals nearer anal than pectorals. Vertebræ amphicœlian, as usual among fishes. Abdominal and caudal parts of the vertebral column subequal. Air-bladder cellular, bifid in front, lung-like, connected by a glottis with the pharynx, and capable of assisting in respiration. Stomach with a blind sac; no pyloric cœca. No closed oviduct. Intestine with a rudimentary spiral valve. Fresh waters of the United States. A single species known.

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* See Wilder "On the Serrated Appendages of the Throat of Amia," Proc. Amer. Assoc. Adv. Sci. 1876, 259, for a discussion of these curious organs.

51.—AMIA Linnæus.

Bow-fins.

(*Amiatus* Rafinesque.)

(Linn. Syst. Nat. ed. xii, 1766: type *Amia calva* L.)

Characters of the genus included above. (*ἀμία*, ancient name of some fish, probably the bonito, *Sarda mediterranea;* said to be from *a*, privative, and *μία*, one, the fish living in schools.)

83. A. calva L.—*Mud-fish; Dog-fish; Bow-fin; Grindle; "John A. Grindle"; Lawyer.*

Dark olive or blackish above, paler below; sides with traces of dark reticulate markings; lower jaw and gular plate often with round blackish spots. Fins mostly dark, somewhat mottled. Male with a round black spot at base of caudal above, this surrounded by an orange or yellowish shade. In the female this spot is wanting. Lateral line nearly median, directed slightly upward at each end. D. 48 (42–53); A. 10–12; V. 7; Lat. l. 67 (65–70). Head $3\frac{3}{4}$ in length; depth 4 to $4\frac{1}{2}$. Male about 18 inches in length; female 24 or more. Great Lakes and sluggish waters from Minnesota to Virginia, Florida, and Texas; abundant. A voracious fish of remarkable tenacity of life. The flesh is peculiarly soft and pasty, and is of no value for food.

(Linn. Syst. Nat.; Günther, vii, 325: *Amia ocellicauda* Richardson, Fauna Bor.-Amer. iii, 236 (♂): *Amia occidentalis* Dekay, New York Fauna, Fish. 269.)

SUBCLASS PHYSOSTOMI.

(*The Soft-rayed Fishes.*)

Skeleton bony. Ventral fins (if present) abdominal, with the basal segments rudimental. Parietal bones usually united. Air-bladder (if present) connected by an air-duct with the œsophagus. Scales mostly cycloid. Lateral line usually running low. Parietal bones usually united. Præcoracoid generally present. Rays of fins all soft and articulated, except occasionally one or two of the anterior rays of any fin, which may be spinous. Lateral margins of upper jaw usually formed by the maxillaries. Pectoral fin placed low, generally near the ventral line.

This group corresponds essentially to the *Malacopteri Abdominales* of different authors, the *Cycloidei* of Professor Agassiz. Although the typical members of this group differ in many ways from the more special-

ized Physoclistous Teliosts, yet all the subordinate characters disappear as we approach the point of union of the two groups, leaving only the presence of the air-duct as the ultimate distinctive character of the *Physostomi*. In view of this inosculation of the two groups, many writers (following Professor Gill) have united them both into one order, *Teleocephali*, after the exclusion of various aberrant members of each. The retention, in some form, of groups emphasizing the difference between the spinous and the soft-rayed fishes seems to us very convenient. (Order *Physostomi* Günther, v–viii.)

ANALYSIS OF ORDERS OF PHYSOSTOMI.*

A. Præcoracoid arch present.
  B. Symplectic bone none; pterotic simple; anterior vertebræ with ossicula auditus; supraoccipital and parietals co-ossified; maxillary imperfect, forming the base of a barbel; no suboperculum..NEMATOGNATHI, K.
  BB. Symplectic bone present.
    C. Anterior vertebræ co-ossified and with ossicula auditus.
PLECTOSPONDYLI, L.
    CC. Anterior vertebræ similar, distinct, without ossicula auditus.
ISOSPONDYLI, M.
AA. Præcoracoid arch none.
  D. Scapular arch suspended to cranium; a symplectic bone; pterotic and anterior vertebræ simple; parietals separated by supraoccipital.
HAPLOMI, N.
  DD. Scapular arch free behind the cranium; parietals in contact; no symplectic; maxillary bone lost or connate....ENCHELYCEPHALI, O.

ORDER K.—NEMATOGNATHI.

(*The Cat-fishes.*)

Parietals and supraoccipital confluent. Four anterior vertebræ co-ossified, and with ossicula auditus. No mesopterygium. Basis cranii and pterotic bone simple; no coronoid bone. Third superior pharyngeal bone wanting, or small and resting on the fourth; second directed backwards. One or two pairs of basal branchihyals; two pairs branchihyals. Suboperculum wanting. Premaxillary forming mouth border above. Interclavicles present. No scales. Skin naked or with bony plates.

"This division is the nearest ally to the sturgeons (*Chondrostei*) among Physostomous fishes, and I imagine that future discoveries will prove that it has been derived from that division by descent. In the same

* After Cope, Trans. Amer. Phil. Soc. 1870, 452.

way the Isospondylous fishes are nearest the *Halecomorphi*, and have probably descended from some Crossopterygian, near the *Haplistia*, through that order. The affinity of the cat-fishes to the sturgeons is seen in the absence of symplectic, the rudimental maxillary bone, and, as observed by Parker, in the interclavicles. There is a superficial resemblance in the dermal bones." (*Cope*. l. c., 454.)

This group comprises the *Siluridæ* and their relatives, now divided into several families by Professor Gill. (νῆμα, thread; γνάθος, jaw; from the maxillary barbels, which are always present.)

ANALYSIS OF THE FAMILIES OF NEMATOGNATHI.

* Operculum present; dorsal fin, if present, short, anteriorly placed. ..SILURIDÆ, 29.

FAMILY XXIX.—SILURIDÆ.

(*The Cat-fishes.*)

Body more or less elongate, naked or covered with bony plates. No true scales. Anterior part of head with two or more barbels, the base of the longest pair formed by the rudimentary maxillary. Margin of upper jaw formed by premaxillaries only. Suboperculum absent; operculum present. Dorsal fin usually present, short, above or in front of the ventrals. An adipose fin usually present. Anterior rays of dorsal and pectorals usually spinous. Air-bladder usually present, large, and connected with the organ of hearing by means of the auditory ossicles. Lower pharyngeals separate.

After the removal of numerous aberrant forms as distinct families, the family of *Siluridæ*, as understood by Professor Gill, contains more than 100 genera and upward of 900 species. Most of the *Siluridæ* are fresh-water fishes, inhabiting the rivers of warm regions, particularly South America and Africa. Comparatively few of them are marine, and these few are mostly tropical.

Our species all belong to the division called by Dr. Günther, *Siluridæ Proteropteræ*, and thus characterized:

"The rayed dorsal is always present, short, with not more than 12 soft rays, and belongs to the abdominal portion of the vertebral column, being placed in advance of the ventrals. The adipose fin is always present and well developed, although frequently short. The extent of the anal is much inferior to that of the caudal vertebral column. The gill membranes are not confluent with the skin of the isthmus, their

posterior margins always free, even if they are united with each other. Whenever a nasal barbel is present it belongs to the posterior nostril."

(*Siluridæ* part Günther, v, 30–65, 69–220: *Heteropteræ*, *Proteropteræ*, and *Stenobranchiæ*.)

* Anterior and posterior nostrils remote from each other, the posterior provided with a barbel; vomer and palatines toothless; barbels 8. (*Ictalurinæ*.)

a. Adipose fin keel-like, adnate to the back; supraoccipital bone free behind. NOTURUS, 52.

aa. Adipose fin with its posterior margin free.

b. Premaxillary band of teeth with a lateral backward extension on each side ..... PILODICTIS, 53.

bb. Premaxillary band of teeth truncate behind.

c. Caudal not forked.

d. Eyes concealed beneath the skin ..... GRONIAS, 54.

dd. Eyes normal ..... AMIURUS, 55.

cc. Caudal forked ..... ICTALURUS, 56.

** Anterior and posterior nostrils close together, neither with a barbel, the posterior with a valve; teeth on the palate. (*Ariinæ*.)

e. Lower jaw with 4 barbels ..... ARIUS, 57.

ee. Lower jaw with 2 barbels ..... ÆLURICHTHYS, 58.

52.—NOTURUS Rafinesque.

Stone Cats.

(*Noturus* Raf. Amer. Month. Mag. and Crit. Rev. iv, Nov. 1818, 41: type *Noturus flavus* Rafinesque.)

Body more or less elongate, anteriorly subcylindrical, thence more or less compressed. Head above ovate and depressed. Skin very thick, entirely concealing the bones. Supraoccipital entirely free from the head of the second interspinal. Eyes small. Mouth anterior, rather large, the upper jaw usually more or less projecting beyond the lower. Teeth subulate, closely aggregated in a broad band in each jaw, which in the lower one is interrupted by a linear interval and in the upper one is continuous. The band in the upper jaw is either abruptly truncated at each end (subgenus *Schilbeodes*) or prolonged backward by a continuation from the postero-external angle (subgenus *Noturus*). Branchiostegals 9. Dorsal fin situated over the posterior half of the interval between the pectoral and ventral fins, with a short, sharp spine and 7 branched rays. Adipose fin long and low, more or less connected with the accessory rays of the caudal fin, not free posteriorly, but adnate to the body; the membrane sometimes high and continuous, sometimes notched. Caudal fin very obliquely truncated or rounded, inserted on an equally obliquely rounded base. Rays rapidly decreasing in length inferiorly; numerous rudimentary ones present, both above

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and below the caudal peduncle. Anal fin comparatively short, and rapidly increasing in height for the first half of its length; it has 12–20* rays. Ventrals rounded, and each has 1 simple and 8 branched rays. Pectoral fins with a sharp spine, of different forms in the different species. Vent at some distance in advance of the anal. Lateral line complete. In or above the axil of the pectoral fins is an orifice, which is the opening of the duct of a poison gland. "From it may frequently be drawn a solid gelatinous style ending in a tripod, each limb of which is dichotomously divided into short branches of regular length." (*Cope.*) Size small. Fresh waters of the United States. (νῶτος, back; οὐρὰ, tail; "means tail over the back", *Rafinesque.*)

*Premaxillary band of teeth without lateral backward processes. (*Schilbeodes*† Bleeker.)

†Pectoral spine entire or grooved behind; adipose fin high and continuous with the caudal.

a. Pectoral spine about half the length of the head.

84. N. gyrinus (Mitchill) Raf.

Nearly uniform yellowish brown, sometimes blackish, without transverse blotches; a narrow dark lateral streak and one or more dorsal ones. Body comparatively short and thick. Head large, its width $3\frac{1}{2}$–$4\frac{1}{2}$ in length of body; depth 4–$5\frac{1}{2}$; head $3\frac{1}{2}$–4. Spines stout and rather long; that of the pectoral fin straight, grooved behind, $2\frac{1}{3}$ in the distance from snout to dorsal fin. Dorsal higher than long, inserted nearer anal than snout. Anal 13. Jaws nearly equal. Humeral process short. L. 5 inches. New York, entire Mississippi Valley, and Upper Lake region; rather common.

(*Silurus gyrinus* Mitchill, Amer. Month. Mag. 1818, 322; Jordan, Bull. U. S. Nat. Mus. x, 102: *Noturus sialis* Jordan, Bull. U. S. Nat. Mus. x, 102, 1877.)

aa. Pectoral spine less than one-third the length of the head.

85. N. leptacanthus Jordan.

Color yellowish, somewhat mottled. Body slender. Head small and narrow, longer than broad. Eye small. Upper jaw much projecting. Spines very short and slender; that of the dorsal not one-third the height of the fin; all less than one-third the length of the head; that of the pectoral retrorsely serrate on the outer edge, entire within. Head $4\frac{4}{5}$ in body; its width $5\frac{1}{2}$; depth $5\frac{1}{2}$; distance to dorsal $2\frac{4}{5}$; pectoral spine

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*Throughout the account of this family the rudimentary rays at the front of the anal are included in the enumeration.

†Bleeker, Ichthyologiæ Archipelagi Indici Prodromus, i, Siluri, 258: type *Silurus gyrinus* Mitch. (*Schilbe*, another genus of *Siluridæ*; εἶδος, like.)

5 in this distance; dorsal nearer anal than snout. Anal 14. Humeral process very short. L. 3 inches. Georgia to Mississippi; not abundant.

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1877; Jordan, l. c. 102.)

†† Pectoral spine serrate behind, roughish in front; adipose fin emarginate.

bb. Pectoral spines extremely strong, more than half the length of head, curved; their posterior serræ strong, spine-like, hooked backward, each about as long as the diameter of the spines.

86. N. miurus Jordan.

Body much mottled, black and grayish. Top of head, tip of dorsal, middle of adipose fin, and edge of caudal definitely blackish. Body with four broad cross-blotches, one before dorsal, one behind it, one on middle of adipose fin, and one small one behind it. Adipose fin connected with the caudal fin. Distance from snout to dorsal about $2\frac{2}{3}$ in length. Pectoral spine $2\frac{1}{3}$ in this distance. Dorsal fin higher than long. Body not very elongate nor much depressed. Dorsal region often somewhat elevated. Depth usually $4\frac{1}{2}$–5 in length; head $3\frac{3}{4}$–4. Dorsal nearer anal than tip of snout. Anal 12 or 13 rays. Pectoral spine curved and finely serrate without, with six strong recurved pectinations within, each nearly as long as the diameter of the spine. Humeral process short. L. 4 inches. Great Lakes to Minnesota and Louisiana; common.

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1877, 371; Jordan, l. c. 100.)

87. N. eleutherus Jordan.

Color much as in *N. miurus*, extensively variegated. Snout, cheeks, and occipital region black. A black bar across front of dorsal, one behind dorsal, and another across middle of adipose fin; base of caudal fin black. One or two narrow horizontal black bars across dorsal and anal near their tips. Caudal vaguely barred, largely black, its tip white. Body stout, broad forward, tapering behind. Head large, flattish, $3\frac{3}{4}$ in length of body, without caudal; depth of body $5\frac{1}{3}$ in length; width of head $4\frac{1}{3}$ in length of body. Mouth large, the upper jaw much projecting; barbels rather long. Adipose fin rather high, so deeply notched that the continuity of the fin is broken for a distance nearly equal to the diameter of the eye. A keel on the back in front of the adipose fin. Caudal fin rounded. Distance from snout to dorsal $2\frac{2}{3}$ in length of body. Pectoral spine in this distance 2 times; in head $1\frac{1}{2}$. Dorsal spine one-half the height of the fin; $3\frac{1}{4}$ times in distance from snout to dorsal; $2\frac{1}{2}$ in length of head. Pectinations of pectoral spine very strong, recurved, nearly as long as the diameter of the spine. Front of pectoral spine with small teeth turned forward. Fin-radii: D.

I, 6; A. 13; P. I, 8; V. 9. Humeral process long. L. 5 inches. Rivers of North Carolina and East Tennessee.

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1877, 371; Jordan, l. c. 101.)

bb. Pectoral spines shortish, nearly straight, less than half length of head; the serratures weak, less than half the diameter of the spine; body elongated.

88. N. exilis Nelson.

Color brown, mottled, the fins somewhat margined with dusky. Pectoral spine slightly retrorse-serrate without, with about 6 small straight teeth within, which are not one-third the diameter of the spine in length. Head small, not very broad, but thin and depressed; its width 5–6 in length of body; jaws nearly equal; head 4 in length, depth 5–6½. Dorsal scarcely higher than long. Distance from snout to dorsal about 3 in length. Pectoral spine 3½–4 in this distance; dorsal spine low, as near snout as anal. Anal rays 14–17. Humeral process obscure. L. 4 inches. Wisconsin to Missouri and Kansas.

(Nelson, Bull. Ill. Mus. Nat. Hist. 1876, 51; Jordan, l. c. 100.)

89. N. insignis (Rich.) Gill & Jordan.

Color dark brown, somewhat mottled, fins all dark-edged. Body rather elongate. Pectoral spine retrorse-serrate without, weakly serrate within. Head very broad, flat, and thin, upper jaw projecting; head about 4¼ in length, depth 6. Dorsal fin one-fourth higher than long. Distance from snout to dorsal about 2¾ in length. Length of pectoral spine 2¾ in same distance. Dorsal much nearer anal than snout. Anal rays 16–20. Humeral process conspicuous, sharp. Size large; reaches the length of nearly a foot. Pennsylvania to South Carolina; common.

(*Pimelodus insigne* Richardson, Fauna Bor.-Amer. iii, 32, 1836, based on *Pimelode livrée* Le Sueur, Mém. Mus. v, 155: *Pimelodus lemniscatus* C. & V. xv, 144: *Noturus occidentalis* Günther, v, 105: *Noturus marginatus* (Baird) Cope, Journ. Acad. Nat. Sci. Phila. 1869, 237; Jordan, l. c. 100.)

**Premaxillary band of teeth with lateral backward processes, as in *Pilodictis*. (*Noturus.*)

90. N. flavus Raf.—*Stone-cat.*

Color nearly uniform yellowish brown, sometimes blackish above, fins yellow-edged. Body elongate. Head depressed, broad and flat, nearly as broad as long. Middle region of body subcylindrical. Tail compressed. Head about 4¼ in length; width of head 5⅓; depth 5⅔ in length. Distance to dorsal about 3 in length. Barbels short. A strong keel on back behind dorsal, leading to adipose fin; adipose fin deeply notched. Dorsal spine very short. Pectoral spine retrorsely serrate in

front, slightly rough or nearly entire behind; its length 3 times in distance from snout to dorsal. Anal rays about 16. Humeral process very short and sharp. Size very large; reaches a length of more than a foot. Vermont to Virginia, Nebraska, and Texas; rather common.

(Rafinesque, Amer. Month. Mag. 1818, 41; Günther, v, 104; Jordan, l. c. 99: *Noturus occidentalis* Gill, Proc. Bost. Soc. Nat. Hist. 1852, 45: *Noturus platycephalus* Günther, v, 104.)

53.—PILODICTIS Rafinesque.

Mud Cats.

(*Opladelus* Raf. 1820.)

(Rafinesque, Prodrome de soixante-dix nouveaux genres, etc., Journ. Phys. Paris, 1819, 422: type *Pilodictis limosus* Raf. = *Silurus olivaris* Raf.)

Body much elongated, very slender, much depressed, anteriorly broader than high. Head large, very wide and depressed, latterly expanded, above broadly ovate, and in profile cuneiform. Skin very thick, entirely concealing the skull. Supraoccipital bone entirely free from the head of the second interspinal. Eyes small. Mouth very large, anterior and transverse. The lower jaw always projects beyond the upper. Teeth in broad villiform bands on the intermaxillaries and dentaries. The intermaxillary band is convex anteriorly, and proceeds to the insertion of the maxillaries, where it is abruptly angularly deflected, and proceeds backward as an elongated triangular extension. The band at the symphysis is slightly divided, and anteriorly separated by a small triangular extension of the labial membrane. The lower band of teeth is anteriorly semicircular and attenuated to the corners of the mouth. There are about 12 branchiostegal rays on each side. The dorsal fin is situated over the posterior half of the interval between the pectorals and ventrals, and has a spine and about 7 branched rays. The spine is rather small, and more or less enveloped in the thick skin. The adipose fin is large, and has an elongated base resting over the posterior half of the anal; it is very obese and inclines rapidly backward; it is rather less free posteriorly than in *Amiurus*. The anal fin is small; it commences far behind the anus, is a little longer than high, and is composed of about 13 rays. The caudal fin is oblong, subtruncated, placed on a vertical basis, and with numerous accessory simple rays, recurrent above and beneath the caudal peduncle. The pectorals have a broad compressed spine, serrated or dentated on its external and internal margins, and with a prolonged fleshy integument obliquely striated. The ventrals are rounded and have 9 rays, 1 simple and 8 branched. One species known. (πελός, mud; ἰχθύς, fish.)

91. P. olivaris (Raf.) Gill & Jordan.—*Mud Cat; Yellow Cat; Bashaw; Goujon.*

Mottled brown and yellowish, the latter color often predominant; whitish below. Body very long, slender, depressed forwards, closely compressed behind, the head extremely flat, the lower jaw the longer. Barbels short. Dorsal spine half the height of the fin. Caudal slightly emarginate. Anal fin short, its base about one-sixth the length, its rays 12–15. Humeral process short. Size very large, reaching a weight of 50–75 pounds. Rivers of the Mississippi Valley and Southern States; abundant in deep, sluggish waters. A fish of unprepossessing appearance, although much used as food.

(*Silurus olivaris* Raf. Amer. Month. Mag. 1818, 355: *Hopladelus olivaris* Gill, Ichth. Capt. Simpson's Expl. 1876, 426: *Pelodichthys olivaris* Jordan, l. c. 95: *Pimelodus punctulatus* Günther, v, 101: *Pimelodus limosus* Raf. Ichth. Oh. 67: *Pimelodus æneus* C. & V. xv, 135.)

54.—GRONIAS Cope.

Blind Cats.

(Cope, Proc. Acad. Nat. Sci. Phila. 1864, 231: type *Gronias nigrilabris* Cope.)

This genus agrees with *Amiurus* in all respects, except that the eyes are rudimentary and covered by the thick skin. The single species is probably descended from some *Amiurus* of the type of *melas*, modified in accordance with its subterranean life. (γρώνη, a cavern.)

92. G. nigrilabris Cope.

Black above; jaws and fins black; sides varied with yellowish; belly pale. Eyes more or less rudimentary and concealed beneath the skin. Jaws equal. Muzzle flat. Dorsal spine midway between snout and middle of adipose fin. Barbels short. Caudal slightly emarginate. Anal with 18 rays. Branchiostegals 10. Cave streams (Conestoga River), Eastern Pennsylvania.

(Cope, Proc. Acad. Nat. Sci. Phila. 1864, 231: *Amiurus nigrilabris* Jordan, l. c. 92.)

55.—AMIURUS Rafinesque.

Cat-fishes.

(*Ameiurvs* Rafinesque, Ichth. Oh. 1820, 65: type *Silurus cupreus* Raf. = *Pimelodus natalis* Le Sueur.)

Body moderately elongated, robust, anteriorly vertically ovate and scarcely compressed; caudal peduncle also robust, but much compressed, and at its end evenly convex. Head large, wide, laterally expanded, above ovate, and in profile cuneiform; supraoccipital extended little posteriorly and terminating in a more or less acute point, which is entirely separate from the second interspinal buckler; the skin covering

the bones is thick. Eyes rather small, not covered by the skin. Mouth large, terminal, transverse, the upper jaw in most species the longer. Teeth subulate, aggregated in broad bands on the intermaxillaries and dentaries; the intermaxillary band is convex in front, of equal breadth, and abruptly truncated near the insertion of the intermaxillaries; the lower dental band is anteriorly semicircular, attenuated to the angles of the mouth. Branchiostegal rays 8–11. Dorsal situated over the interval between the pectorals and ventrals, higher than long, with a pungent spine and about 6 branched rays. Adipose fin short, inserted over the posterior half of the anal. Anal fin varying length, with 15–35 rays, the usual number being 20 or 21. Caudal fin short, usually truncate when spread open, slightly emarginate when not expanded. Ventrals each with 1 simple and 7 branched rays. Pectoral fins each with a stout spine, which is commonly retrorse-serrate behind. Lateral line usually incomplete. Species very numerous, swarming in every pond and sluggish stream in the Eastern United States; one species (*A. cantonensis*) in China. (*a*, privative; *μείουρος*, curtailed; the caudal fin not notched.)

* Caudal fin not forked, rounded or slightly emarginate.

a. Anal fin very short, its rays 15–17 (18).

b. Body comparatively long and slender.

93. A. brunneus Jordan.—*Green Mud Cat.*

Clear olive-brown, more distinctly greenish than other cat-fishes; a blackish horizontal bar at base of dorsal. Body extremely elongate; anteriorly nearly terete. Head low, flat, and broad, upper jaw very strongly projecting. Dorsal fin very high, two-thirds length of head, its spine nearer snout than adipose fin; depth $5\frac{1}{2}$ in length. Head $3\frac{1}{2}$; its width 4; base of anal 6; anal rays 16–18. Caudal slightly emarginate. Young much less elongate. L. 18 inches; slenderest of the *Amiuri*. Abundant in the streams of South Carolina and Eastern Georgia (Santee to the Chattahoochee).

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1877, 366; Jordan, l. c. 93; Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 28.)

aa. Anal fin moderate, its rays 19–22.

c. Lower jaw not projecting beyond upper.

94. A. platycephalus (Grd.) Gill.

Olivaceous, somewhat marbled, a black horizontal bar at base of dorsal. Head broad and flat, nearly as wide as long. Mouth very wide, the jaws about equal. Dorsal spine nearer snout than adipose fin. B. 11; A. 20–22, the base of the fin $4\frac{1}{2}$–5 in length. North Carolina to

Georgia; rather common. Resembles *A. brunneus*, but less slender and with a different mouth.

(*Pimelodus platycephalus* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 161; Jordan, l. c. 93.)

95. A. xanthocephalus (Raf.) Gill.

Chiefly uniform yellowish brown, often rather pale. Head about as broad as long, 4 in length. Dorsal spine nearer adipose fin than snout, its rays usually 19 (18–20). Mouth very broad. Body short and stout. Barbels shorter than head. Humeral process very short, covered by skin. Size small. Ohio Valley.

(*Silurus xanthocephalus* Raf. Quart. Journ. Sci. Lit. Arts, Lond. 1820, 51; Jordan, l. c. 42.)

96. A. melas (Raf.) Jordan & Copeland.—*Bull-head.*

Color almost black. Body very stout, short, and deep, the depth $3\frac{1}{2}$ to $4\frac{1}{4}$ in length. Head broad behind, rather contracted forward, the front steeply elevated. Anal fin short and deep, of 17–19 rays, its base nearly 5 in length, the color of the rays forming a sharp contrast with that of the dusky membranes. Jaws nearly equal. Barbels longer than head. Humeral process rather long, rugose. Size small. Mississippi Valley to New York; common.

(*Silurus melas* Raf. Quart. Journ. Sci. Lit. Arts, Lond. 1820, 51: *Pimelodus catulus* Grd. Ichth. U. S. Pac. R. R. Surv. 1858, 208: *Pimelodus confinis* Grd. Proc. Acad. Nat. Sci. Phila. 1859, 159: *Amiurus obesus* Gill, Proc. Bost. Soc. Nat. Hist. 1862, 45; Jordan, l. c. 89: *Pimelodus pullus* DeKay, New York Fauna, Fish. 184: *Amiurus pullus* Jordan, l. c. 93.)

97. A. marmoratus (Holbrook) Jordan.

Body sharply mottled with brown, greenish, and whitish; the coloration therefore singular among cat-fishes. Jaws equal, or nearly so; depth about 4 in length; slope of profile very steep. Dorsal fin high; the spine more than half length of head. Dorsal spine nearer adipose fin than snout. Barbels long. Branchiostegals 10. Head $3\frac{1}{4}$ in length. Anal 21. L. 15 inches. Southern Illinois to Florida. Perhaps a variety of *A. catus*.

(*Pimelodus marmoratus* Holbrook, Journ. Acad. Nat. Sci. Phila. 1855, 54: Jordan, l. c. 89.)

98. A. catus (Linn.) Gill.—*Bull-head; Horned Pout; Small Cat-fish; Schuylkill Cat; Sacramento Cat.*

Color dark yellowish brown, more or less clouded, sometimes yellowish, sometimes nearly black. Body rather elongate; depth 4–$4\frac{1}{2}$ in length. Anal fin usually with 21 or 22 rays, its base 4 in body. Dorsal fin inserted rather nearer adipose fin than end of snout. Upper jaw usually distinctly longer than lower. Humeral process more than half

the length of pectoral spine. L. 18 inches. Great Lakes, Ohio Valley, and eastward. The common bull-head or horned pout of the North and East, abundant in every pond and stream; also introduced into the rivers of California, where it has rapidly multiplied.

(? *Silurus catus* Linn. Syst. Nat. x, 305, 1758: *Pimelodus nebulosus* Le Sueur, Mém. Mus. v, 149, 1819: *Pimelodus atrarius* DeKay, New York Fauna, Fish. 1842, 185; Jordan, l. c. 90.)

cc. Lower jaw projecting beyond upper.

99. A. vulgaris (Thompson) Nelson.

Dark reddish brown or blackish. Body moderately elongate; depth 4½–5 in length. Head 3½–4. Barbel long. Mouth wide. Head longer than broad, rather narrowed forward. Profile rather steep, pretty evenly convex. Dorsal region more or less elevated. Lower jaw strongly projecting. Anal rays 20. L. 18 inches. Vermont to Minnesota and southward; rather common.

(*Pimelodus vulgaris* Thompson, Hist. Vermont, 1842, 138: *Pimelodus dekayi* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 160: *Pimelodus ailurus* Girard, U. S. Pac. R. R. Expl. Fish. 1858, 210; Jordan, l. c. 88.)

aaa. Anal fin long, of 24–27 rays, its base more than one-fourth the length.

d. Head broad; mouth wide.

100. A. natalis (Le Sueur) Jordan.—*Yellow Cat.*

Yellowish, greenish, or blackish. Body more or less short and chubby, sometimes extremely obese (var. *natalis*), sometimes more elongate (var. *lividus*). Head short and broad. Mouth wide, the jaws equal (var. *lividus*) or the upper jaw longest (var *cupreus*). Anal rays 24–27. Great Lake region to Virginia and Texas; generally abundant. Extremely variable, and running into several varieties.*

(*Pimelodus natalis* Le Sueur, Mém. Mus. v, 154, 1819; Günther, v, 101; Jordan, l. c. 86: *Silurus lividus* Rafinesque, Ichth. Oh. 1820, 65: *Pimelodus felinus* et *antoniensis* Grd. U. S. Pac. R. R. Expl. x, 209, 291: *Pimelodus catus, cupreus,* et *cuprcoides* Grd. Proc. Acad. Nat. Sci. Phila. 1859, 159, 160: *Pimelodus cœnosus* Richardson, Fauna Bor.-Amer. iii, 132: *Pimelodus cupreus* Raf. Ichth. Oh. 1820, 65.)

dd. Head elongate; mouth narrow.

101. A. erebennus Jordan.

Color black; belly paler; fins and barbels black. Body rather elongate, compressed, the depth about 4⅓ in length. Dorsal region rather elevated; the head quite long and narrowed forward, 4 times in length of body. Head more narrowed than in any of the other species. Width of the head in front of the eye but little more than half its length. Width of the mouth about half the length of the head.

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* For a discussion of which see Jordan, Bull. U. N. Nat. Mus. x, 86.

Greatest width of the head contained about 1⅓ times in its length. Dorsal fin slightly nearer the snout than the adipose fin, unusually high, its spine long, as in the species of *Ictalurus*. Pectoral spine very strong, about half as long as the head. Anal fin long, deep, nearly one-third the length of the body, and composed of 24 rays. Adipose fin large. Caudal fin rather short, truncate behind. Jaws equal. Supra-occipital bone but little free behind. Branchial apertures rather more restricted than usual. Resembles *I. lacustris*, but with the truncate caudal of *A. natalis*. Rivers of Florida.

(Jordan, Bull. U. S. Nat. Mus. x, 85.)

56.—ICTALURUS Rafinesque.

Channel Cats.

(Rafinesque, Ichth. Oh. 1820, 61: type *Silurus punctatus* Rafinesque.)

Body elongated, slender, and much compressed. Head usually slender and conical. The supraoccipital bone is prolonged backward, and its emarginated apex, in typical species, receives the acuminate anterior point of the second interspinal, thus forming a continuous bony bridge from the head to the dorsal spine. In some species, this connection is more or less imperfect, as in *Amiurus*, to which genus all such species have been hitherto referred. Mouth transverse and terminal, the upper jaw protruding beyond the lower. Teeth subulate, aggregated into a short, laterally truncated band on each jaw. Branchiostegal rays 8 or 9. Dorsal fin situated over the interval between the pectoral and ventral fins, higher than long, with one long spine, and usually 6 articulated rays. Adipose fin pedunculated, over the posterior portion of the anal. Anal fin long, with 20–35 rays; it commences near the vent. Ventral fins each with 1 simple and 7 branched rays. Pectoral fins each with a stout spine, retrorse-serrate within, and about 9 branched rays. Caudal fin elongated and deeply forked, with the lobes pointed, the upper frequently the longer. Coloration silvery. Fresh waters of North America, one species southward to Guatemala;* one in Western Mexico.†

**I. meridionalis* (Günther) Jordan. Allied to *I. furcatus*, but the anal shorter, the depth 5 in length. A. 28–29. Rio Usumacinta, Guatemala. (*Amiurus meridionalis* Günther, v, 102.)

†*I. dugesi* (Bean) J. & G. Closely allied to *I. albidus*, but with a narrower head (its width 5 in length); the width of the premaxillary band of teeth about one-third the length of the head; humeral process slightly furrowed, not strongly rugose as in *I. albidus*. Caudal deeply forked. Color plumbeous, silvery below. B. 8; D. I, 6; A. 21; P. I, 8. Rio Turbio, Guanajuato, Mexico (west of the Sierra Madre). (*Amiurus dugesi* Bean, Proc. U. S. Nat. Mus. ii, 304, 1879.)

(*ἰχθύς*, fish; *αιλουρος*, cat; hence more correctly, though less euphoniously, *Ichthælurus*.)

a. Bony bridge from occiput to dorsal not quite continuous.
b. Anal fin moderate, of 20–22 rays.

102. I. lophius (Cope) J. & G.

Pale olive-bluish, silvery below. Body rather stout. Head very broad, about as wide as long, its width $3\frac{3}{4}$ in length of the body. Eye 5–6 in interorbital width. Caudal not deeply forked. Upper jaw not much the longer. Mouth wider than in any other cat-fish. Humeral process stout, shortish, somewhat rugose. Anal rays 21; base of anal 6 in length. L. 24 inches. Streams about Chesapeake Bay.

(*Amiurus lophius* Cope, Proc. Amer. Phil. Soc. 1870, 486: *Amiurus lophius* Jordan, l. c. 85.)

103. I. albidus (Le Sueur) J. & G.—*White Cat; Channel Cat of the Potomac.*

Pale olive-bluish, silvery below. Body moderately stout. Head longer than wide, its width 4–6 times in length. Mouth rather narrow. Upper jaw much the longer. Eye 3–5 in interorbital width. Barbels long, except nasal barbel. Caudal fin deeply forked, the upper lobe the longer. Humeral process more than half the length of the spine, extremely rugose. Anal rays 21; base of anal $4\frac{1}{2}$–5 in length. Dorsal fin nearly midway between adipose fin and snout. L. 18 inches. Pennsylvania to North Carolina.

(*Pimelodus albidus* Le Sueur, Mém. Mus. v, 148, 1819: *Pimelodus lynx* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 160: *Amiurus albidus* Jordan, l. c. 84.)

bb. Anal fin long, of 23–27 rays.

104. I. lupus (Grd.) J. & G.

Dusky olivaceous, sides silvery. Body rather slender. Head narrow, longer than broad, its width $4\frac{3}{4}$ in length, being less than its length above. Dorsal spine much nearer snout than adipose fin. Base of anal as long as head. Anal 23. Pectoral spines long and slender, dentate. Barbels long. Supraoccipital bone almost meeting the interspinal; its relations therefore very close to *Ictalurus punctatus*. Streams of Texas.

(*Pimelodus lupus* Grd. U. S. Pac. R. R. Expl. x, 211: *Amiurus lupus* Jordan, l. c. 83: *Amiurus lupus* Günther, v, 101.)

105. I. niveiventris (Cope) J. & G.

Similar to *I. lupus*, but the head broader, its width equal to its length above. Dorsal spine scarcely nearer snout than adipose fin. Anal 24, shorter than head. Barbel longer than head; humeral process very rugose. Neuse River, North Carolina.

(*Amiurus niveiventris* Cope, Proc. Amer. Phil. Soc. 1870, 486: *Amiurus niveiventris* Jordan, l. c. 83.)

106. I. lacustris (Walbaum) J. & G.—*Cat-fish of the Lakes; Great Fork-tailed Cat; Mississippi Cat; Florida Cat; Flannel-mouth Cat.*

Olivaceous slaty, growing darker with age; sides pale, without dark spots; anal dusky edged. Body rather stouter than in *I. punctatus.* Head much broader, lower, and more depressed than in *I. punctutus*, its greatest width five-sixths its length. Interorbital space somewhat more than half the length of head. Width of the mouth about half head. Eye moderate, wholly in front of middle point of head. Top of head covered with a thicker skin than in *punctatus*, so that the bones are nearly concealed. Upper surface of head quite flattish, so that the eyes are much nearer the upper than the lower surface of the head. Barbels long, all black, the maxillary barbel reaching beyond head. Humeral process very short and blunt, covered by skin, a little more than one-third the length of the pectoral spine. Caudal deeply forked, the upper lobe rather longer and narrower than the lower. Dorsal a little nearer snout than adipose fin. Head 4 in length; depth 5. Distance to dorsal spine $2\frac{3}{4}$. Anal base as long as head. D. I, 5; P. I, 9; A. 25. British America to Florida and Texas; abundant in all large bodies of water. One of the largest of the cat-fishes, reaching a weight of 100 pounds.

(*? Gadus lacustris* Walbaum, Artedi Pisc. 1792, 144: *? Pimelodus borealis* Richardson, Fauna Bor.-Amer. Fish. 135: *?Amiurus borealis* Günther, v, 100: *Pimelodus nigricans* Le Sueur, Mém. Mus. v, 153, 1819: *Amiurus nigricans* Jordan, l. c. 83: *Amiurus borealis* Jordan, l. c. 84.)

bbb. Anal fin very long, of 35 rays.

107. I. ponderosus (Bean) J. & G.—*Great Cat-fish.*

Bluish slate above, whitish below. Form of *I. lacustris*, but the body deeper and the head and mouth broader. Greatest depth $3\frac{1}{2}$ in length. Head $3\frac{2}{3}$; its width $4\frac{3}{4}$. Dorsal nearer snout than adipose fin. Caudal fin not deeply forked. P. I, 11; A. 35. (*Bean.*) Mississippi River (Saint Louis). Probably the largest of the cat-fishes, the original type 5 feet in length and weighing 150 pounds.

(*Amiurus ponderosus* Bean, Proc. U. S. Nat. Mus. ii, 286, 1879.)

aa. Bony bridge from occiput to dorsal fin complete and continuous.

d. Anal moderate, its rays 24–30, its base $3\frac{1}{2}$–4 in length of body.

108. I. punctatus (Raf.) Jor.—*Channel Cat; White Cat.*

Color light olivaceous above, the sides pale or silvery, and almost always with irregular small, round, dark spots. Fins often with dark edgings. Body rather long and slender, the back little elevated. Head rather small, narrow, convex above, so that the eye is little

nearer the upper than the lower outline. Eye large, the middle point of the length of the head being near its posterior margin. Mouth rather small. Barbels long. Spines long. Skin thin. Humeral process long and slender, more than half the length of the pectoral spine, which is strongly serrated behind. Head 4; depth 5. Anal 25–29. Rivers of the Southern and Western States, from Montana to Vermont, Mexico, and Georgia; generally abundant in the channels of the larger streams. It reaches a weight of 20–25 pounds. Variable.

(*Silurus punctatus* Raf. Amer. Month. Mag. 1818, 359; Jordan, l. c. 76: *Pimelodus cærulescens* Raf. Ichth. Oh. 63: *Pimelodus caudafurcatus* Le Sueur, Mém. Mus. v, 152: *Amiurus caudafurcatus* Günther, v, 102: *Pimelodus furcifer, gracilis, vulpes, olivaceus, houghi, megalops, graciosus, hammondi, notatus*, etc. Auct.: *Ictalurus beadlei* and *simpsoni* Gill: *Ichthælurus robustus* Jordan, l. c. 76.)

dd. Anal fin very long, its rays 32–34.

109. I. furcatus (Cuv. & Val.) Gill.

Color silvery, plain or somewhat spotted. Anal fin extremely elongate, its base nearly one-third the length of the body (without caudal); its rays 32–34 in number. Eye small, wholly anterior, the middle of the head being entirely behind its posterior margin. Head small, about 4½ in length; depth 4 in adults to 5½ in younger specimens Slope from dorsal to snout somewhat concave, especially in adults. Pectoral spine rather long; humeral spine stout, shortish, not reaching middle of pectoral spine. Skin thin. Size rather small. Ohio to Iowa and Texas; not very common.

(*Pimelodus furcatus* Cuv. & Val. xv, 136, 1840: *Amiurus furcatus* Günther, v, 103; Jordan, l. c. 75.)

57.—ARIUS Cuvier & Valenciennes.

Sea Cat-fish.

(Cuvier & Valenciennes, Hist. Nat. Poiss. xv, 53, 1840: type *Pimelodus arius* Buchanan.)

Body more or less elongate, subterete. Head subconical, armed with a bony shield above, behind which are usually two others, the posterior at the base of the dorsal spine. Skull with a fontanelle. Mouth not large, the upper jaw the longer. Teeth villiform or granular, in a band in each jaw. Teeth in one or two patches each on the vomer and palatines, all of them sometimes confluent into one band. Barbels 6 (the nostrils without barbel), close together, the posterior with a valve. Eyes with a free orbital margin. Dorsal fin short, in front of the ventrals, with a pungent spine and 7 rays. Adipose fin well developed, posteriorly free. Caudal fin deeply forked. Anal fin short. Pectorals each with a spine. Ventral rays 6. Skin smooth, naked, except on the

occipital and nuchal regions, which are armed with bony bucklers. Marine cat-fishes. Species very numerous in the tropical seas. This group has been divided into many genera, the value of which we are unable to determine. Our common species is not a typical *Arius*, but the genus to which it belongs has not been properly defined. (From *Ari gagora*, the Bengalese name of the typical species.)

a. Teeth all villiform, in a large rounded patch on each palatine and a small one on each side of the vomer, these patches all distinct; posterior buckler small. (*Ariopsis** Gill.)

110. A. felis (Linné) J. & G.—*Sea Cat-fish.*

Steel-blue, sides and belly silvery. Body rather elongate, not compressed, tapering into the slender tail. Head subconic, depressed, flattish above. Maxillary barbel nearly as long as the head. Mouth small. Eye moderate, just in front of the middle of the head. Gill membranes broadly united, partly joined to the isthmus, forming a narrow, free fold across it. A small, bony, granulated buckler, broader than long, in front of base of dorsal spine; then a much larger nuchal shield with a median keel, and a still larger occipital shield with a median furrow. A low fleshy keel along the back. Humeral process nearly half the length of the pectoral spine. Caudal deeply forked, the upper lobe the longer. Head $3\frac{3}{4}$; depth 5. D. I, 7, its spine not filamentous, serrate in front; P. I, 6; A. 16. L. 24 inches. Cape Cod to Florida; common southward.

(*Silurus felis* Linné, Syst. Nat.: *Arius milberti* Cuv. & Val. xv, 74: *Arius milberti* Günther, v, 155.)

111. A. equestris Baird & Girard.

Similar, but with the spines higher and the maxillary barbels much longer, reaching to the middle of the pectorals. Pectorals reaching to last ray of dorsal. Dentition and character of the cephalic bucklers undescribed. Head 4. D. I, 7; A. 16; P. I, 9. Coast of Texas; a doubtful species.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1855, 26; Günther, v, 173.)

58.—ÆLURICHTHYS Baird & Girard.

Sea Cat-fishes.

(*Ailurichthys* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 26: type *Silurus marinus* Mitchill.)

Body rather elongate, little compressed. Head depressed, broad above. Mouth large, the upper jaw the longer. Teeth all villiform; those on the vomer and palatines forming a more or less perfectly crescent-

* *Ariopsis* et *Notarius* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 171: type *Arius milberti* C. & V. (*Arius*; ὄψις, appearance.)

shaped band. Barbels 4. Maxillary barbels band-like, very long. Chin with two short barbels. Nostrils close together, the posterior with a valve; nuchal region with a granulated, bony buckler. Fontanelle large, well forward. Dorsal fin short, in front of the ventrals, with 1 sharp spine and 7 rays. Pectorals with a similar spine; both pectoral and dorsal spines ending in a long, striated, band-like filament. Adipose fin moderate, free behind. Caudal fin widely forked. Anal moderate or rather long. Ventral rays 6. Gill membranes somewhat connected. Tropical waters of America; the species all marine. (*αἴλουρος*, cat; *ἰχθύς*, fish.)

112. Æ. marinus (Mitchill) B. & G.—*Sea Cat-fish; Gaff-top-sail.*

Dusky bluish, silvery below. Head rather short and broad, rounded anteriorly. Eye rather large, low, anterior. Occipital buckler subtriangular, tapering behind. Maxillary barbels extending about to the end of the pectoral spine. Pectoral spine longer than the dorsal spine, two-thirds the length of the head, its filament reaching the vent. Dorsal filament reaching adipose fin. Upper lobe of caudal much the longer. Anal fin falcate. Band of palatine teeth nearly continuous. Head $4\frac{1}{4}$. D. I, 7; A. 23; P. I, 12; B. 6; Vert. 20 + 30. Cape Cod to Mexico; common southward.

(*Silurus marinus* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 433; Günther, v, 178.)

Order L.—PLECTOSPONDYLI.

(*The Plectospondylous Fishes.*)

Physostomous fishes with the parietals broad, distinct; pterotic normal; symplectic present; opercular bones all present; no interclavicles, and the four anterior vertebræ much modified and with ossicula auditus. This group consists principally of fresh-water fishes, and includes about six families. Two strongly marked divisions are included in it, the one the suborder *Eventognathi* of Professor Gill, and the other the Characins, referred by Professor Gill to the *Isospondyli*. The Characins resemble the *Isospondyli* in general appearance and in the structure of the pharyngeals, but differ in the modification of the anterior vertebræ. (*πλεκτὸς*, joined together; *σπόνδυλος*, vertebræ.)

ANALYSIS OF FAMILIES OF PLECTOSPONDYLI.

* Brain case produced between orbits; basis cranii simple; only two superior pharyngeal bones; lower pharyngeals falciform, parallel with the gill-arches; jaws toothless. (*Eventognathi.**)

* *εὖ*, well; *ἐντός*, within; *γνάθος*, jaw.

a. Basal branchihyals 2; pharyngeal teeth numerous, pectinate; maxillaries forming part of the margin of the upper jaw.....CATOSTOMIDÆ, 30.

aa. Basal branchihyals 3; pharyngeal teeth few; margin of upper jaw formed by premaxillaries alone.....CYPRINIDÆ, 31.

** Brain case not produced between orbits; basis cranii double, sometimes with muscular canal; 4 to 1 superior pharyngeal bones; lower pharyngeals not falciform; 3 basal branchihyals; teeth in jaws often present. (*Characini.*)
CHARACINIDÆ, 32.

FAMILY XXX.—CATOSTOMIDÆ.

(*The Suckers.*)

Body oblong or elongate, usually more or less compressed. Head more or less conoid. Opercles normally developed. Nostrils double. No barbels. Mouth large or small, usually protractile and with fleshy lips. Margin of upper jaw formed in the middle by the small premaxillaries, and on the side by the maxillaries. Jaws toothless. Lower pharyngeal bones falciform, armed with a row of numerous comb-like teeth. Branchiostegals 3. Gill membranes more or less united to the isthmus, restricting the gill-openings to the sides. Gills 4, a slit behind the fourth. Pseudobranchiæ present. Scales cycloid, large or small. Lateral line decurved, sometimes wanting. Head naked. Fins not scaly. Dorsal fin comparatively long (of 11–50 rays), without true spine. Anal fin short. Caudal fin more or less forked. Ventrals abdominal, with about 10 rays. Pectoral fins placed low, without spine. No adipose fin. Belly not serrated. Alimentary canal long. Stomach simple. No pyloric cœca. Air-bladder large, divided into two or three parts by transverse constrictions, not surrounded by a bony capsule. Genera 14 or fewer; species about 60; inhabiting the fresh waters of North America, two species in Eastern Asia. They are not much valued as food fishes, the flesh being flavorless and full of small bones.

(*Cyprinidæ*, group *Catostomina* Günther, vii, 12–24.)

* Dorsal fin elongate, its developed rays 25–50 in number; air-bladder in two parts.

† Fontanelle present; body ovate; scales large. (*Bubalichthyinæ.*)

a. Dorsal rays 24–33.

b. Mouth large, terminal, protractile forwards; lips thin; pharyngeal bones and teeth weak.....ICTIOBUS, 59.

bb. Mouth smaller, inferior, protractile downwards.

c. Pharyngeal bones strong, the teeth comparatively coarse and large, increasing in size downwards.....BUBALICHTHYS, 60.

cc. Pharyngeal bones narrow, with the teeth thin and weak..CARPIODES, 61.

†† Fontanelle obliterated by the union of the parietal bones; body elongate. (*Cycleptinæ.*)

d. Mouth small, inferior, with thick papillose lips; scales rather small.
CYCLEPTUS, 62.

** Dorsal fin short, with 10–18 rays. (*Catostominæ.*)

e. Air-bladder in two parts.

f. Lateral line complete and continuous; scales small, 55–115 in the lateral line.

q. Fontanelle none ....PANTOSTEUS, 63.

gg. Fontanelle present.

h. Mouth inferior, small, with thick papillose lips.

CATOSTOMUS, 64.

hh. Mouth very large, terminal, oblique; lips thin and nearly smooth.

i. Pharyngeal bones moderate, with teeth of medium size.

CHASMISTES, 65.

ii. Pharyngeal bones slender, with very numerous, minute teeth.

LIPOMYZON, 66.

ff. Lateral line interrupted or wanting; scales large (40–50 in a longitudinal series).

g. Lateral line entirely wanting .....ERIMYZON, 67.

gg. Lateral line more or less developed.....MINYTREMA, 68.

ee. Air-bladder in three parts; fontanelle present; scales large; lateral line complete.

j. Mouth normal, the lower lip entire or merely lobed.

k. Pharyngeal bones moderate, the teeth compressed, gradually larger downwards; mouth moderate or small, the lips usually plicate .....MOXOSTOMA, 69.

kk. Pharyngeal bones very strong, with the lower teeth much enlarged, subcylindrical and truncate, the teeth of the upper part of the bone small and compressed; mouth large, somewhat oblique, with very thick lips.

PLACOPHARYNX, 70.

jj. Mouth singular, the upper lip not protractile, greatly enlarged, the lower lip developed as two separate lobes, pharyngeal bones and teeth ordinary....QUASSILABIA, 71.

59.—ICTIOBUS Rafinesque.

Buffalo-fishes.

(Rafinesque, Ichth. Oh. 1820, 55: type *Amblodon bubalus* Raf.)

Head very large and strong, wide and deep; its length $3\frac{1}{2}$–$3\frac{3}{4}$ in that of the body; its upper surface broad and depressed. Eye moderate, wholly anterior in position, the middle of the head being entirely behind it; suborbital bones proportionately narrow. Fontanelle large, well open. Opercular apparatus largely developed; the subopercular broad; the operculum broad, strongly furrowed. Mouth very large for a sucker, terminal, protractile forwards; the middle of the premaxillaries nearly on the line of the middle of the eye; the posterior edge of the maxillary extending about to the line of the nostrils. Mandible very strong, oblique, placed at an angle of 45° or more when the mouth is closed, its posterior end extending to beyond opposite the front of the eye, its length a little less than one-third that of the head. Lips very little developed; the upper narrow and smooth, scarcely appreciable; the lower narrow, rather full on the sides, but reduced to a narrow rim in front,

entirely destitute both of papillæ and plicæ. Jaws without cartilaginous sheath. Muciferous system of head well developed. Isthmus narrow. Pharyngeal bones rather weak, the outer surface of the arch standing outwards and presenting a porous outer margin. The peduncle of the symphysis is much longer proportionally and more pointed than in *Carpiodes* and *Bubalichthys*. The teeth are very numerous, small, thin, and compressed as in *Carpiodes*, but the lower ones are gradually larger than the upper ones. Their inner edge is slanting outwards, and not uniformly arched as in *Bubalichthys*, or truncate as in *Cycleptus*, the innermost margin rising somewhat in the shape of a projecting cusp. Gill-rakers of anterior arch long and slender above, becoming shorter downwards. Body heavy, robust, not especially arched above nor greatly compressed, the form somewhat elliptical; the depth $2\frac{1}{2}$–$3\frac{1}{2}$ in the length of the body. Scales large, thick, nearly equal over the body, their posterior edges somewhat serrate; the lateral line well developed, but not as distinct as in *Carpiodes*, slightly decurved anteriorly; the number of scales in its course 36–42; 13–15 in a transverse series from dorsal to ventrals. Dorsal fin with an elongate basis, its number of rays 25–30; anterior rays somewhat elevated, their length about half that of the base of the fin. Caudal not much forked. Anal fin not much elevated, its rays about 9 in number. Pectorals and ventrals moderate, the latter with about 10 rays. Sexual peculiarities, if any, unknown. Coloration dark, not silvery. Air-bladder with two chambers. Size very large. A single species known. (ἰχθύς, fish; βοῦς, buffalo.)

113. I. bubalus (Raf.) Ag.—*Red-mouth Buffalo-fish.*

Body robust, moderately compressed, the outline somewhat elliptical, but the back rather more curved than the belly; depth $2\frac{1}{2}$–$3\frac{1}{2}$ in length. Head very large and thick, $3\frac{1}{2}$ in length of body. Opercular apparatus very strong, the operculum itself forming nearly half the length of the head. Scales very large. Developed rays of the dorsal 27–29; anal rays 9; ventrals 10. Scales 7–37 to 41–6. Coloration dull brownish olive, not silvery. Fins dusky. Size very large; reaches a length of nearly 3 feet and a weight of 20–30 pounds. Mississippi Valley; generally abundant in the larger streams.

(*Amblodon bubalus* Raf. Journ. Phys. 1818, 421; Agassiz, Amer. Journ. Sci. Arts, 1854, 196: *Sclerognathus cyprinella* C. & V. Hist. Nat. Poiss. 1844, 477: **Ichthyobus cyanellus* Nelson, Bull. Ill. Mus. Nat. Hist. i, 49: *Ichthyobus bubalus* Jordan, Bull. U. S. Nat. Mus. xii, 214: *Sclerognathus cyprinella* Günther, vii, 24.)

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* See Jordan, Bull. U. S. Nat. Mus. xii, 207. There has been perhaps a confusion among Mr. Nelson's types of this species. One sent by him to us is an *Ictiobus*.

60.—BUBALICHTHYS Agassiz.

Buffalo-fishes.

(Agassiz, Amer. Journ. Sci. Arts, 1855, 192: type *Carpiodes urus* Ag.)

Head moderate or rather large deep and thick, its superior outline rapidly rising; its length about 4 in that of the body. Eye moderate, median or rather anterior in position. Suborbital bones comparatively narrow. Fontanelle always present and widely open. Mouth moderate or small, more or less inferior; the mandible short, little oblique, or typically quite horizontal; the mandible less than one-third the length of the head; the premaxillaries in the closed mouth below the level of the lower part of the orbit. Lips rather thin, thicker than in *Ictiobus*, the upper protractile, narrow, plicate, the plicæ sometimes broken up into granules; lower lip comparatively full (for a buffalo-fish), faintly plicate, the plicæ broken up into granules, the lower lip having the general ∩-shaped form seen in *Carpiodes*. Jaws without cartilaginous sheath. Muciferous system well developed. Opercular apparatus well developed, but less so than in *Ictiobus;* the operculum strongly rugose; isthmus moderate. Pharyngeal bones triangular, with large teeth, which increase in size from above downwards. Teeth compressed, their grinding edge blunt, slightly arched in the middle, and provided with a little cusp along the inner margin, which is hardly detached from the crown, and does not rise above the surface. Gill-rakers of anterior arch slender and stiff above, growing shorter downwards. Body ovate or oblong; the dorsal outline more or less arched; the sides of the body compressed; the ventral outline curved also, but to a less degree. Scales very large, about equal over the body, their posterior outlines somewhat serrate. Lateral line well developed, nearly straight, with 35–42 scales; 12–14 in a cross-series from ventrals to dorsal. Dorsal fin beginning near the middle of the body, somewhat in advance of the ventrals; its anterior rays elevated, their height about equal to half the base of the fin, the number of rays in the dorsal fin ranging from 25 to 30. Caudal fin well forked, the lobes about equal, not falcate. Anal fin comparatively long and rather low, of 8 or 9 developed rays. Ventrals moderate, 10-rayed. Pectorals rather short. Sexual peculiarities, if any, unknown. Coloration dull dark brown, nearly plain, not silvery. Fins olivaceous or more or less dusky. Air-bladder with two chambers. Size quite large. This genus is closely related to *Ictiobus*, differing only in

the somewhat stronger teeth. The two genera, with perhaps *Carpiodes* also, should probably be reunited. Three species are known, two in the United States and a third in Central America.* (*βούβαλος*, buffalo; *ἰχθύς*, fish.)

114. B. urus Ag.—*Big-mouthed Buffalo.*

Body much less elevated and less compressed than in *B. altus*, the back not at all carinated; axis of body above ventrals about at the lateral line, and but very little farther from the dorsal outline than from the ventral; depth 3–3¼ in length. Head very stout, strongly transversely convex, thicker, larger, and less pointed than in the other, about 4 in length. Eye about equal to snout, 5½ in head, much smaller than in *B. altus*. Mouth large, considerably oblique, opening well forwards. Mandible longer than eye. Premaxillary somewhat below suborbital. Dorsal fin lower and less rapidly depressed than in the next, the longest ray scarcely half the length of the base of the fin. Anal fin rounded; its rays not rapidly shortened; the middle ones not much shorter than the longest. Colors very dark; fins all black. Scales 8–41–7; D. 30; A. 10. Mississippi Valley; in the larger streams.

(*Carpiodes urus* Agassiz, Amer. Journ. Sci. Arts, 1854, 355: *Bubalichthys urus, niger,* et *bonasus* Agassiz, Amer. Journ. Sci. Arts, 1855, 193–195; Jordan, l. c. 209.)

115. B. altus Nelson.—*Small-mouthed Buffalo.*

Body considerably elevated and compressed above; the dorsal region subcarinate; belly thicker; depth 2½–2¾ in length; axis of body above the ventrals, below the lateral line, and nearly twice as far from the back as from the belly. Head moderate, triangular in outline when viewed from the side, 4 in length. Eye equal to snout, 4–5 in length of head, much larger than in *B. urus*. Mouth quite small, notably smaller and more inferior than in *B. urus*. Mandible about equal to eye. Dorsal fin elevated in front and rapidly declined, the highest ray reaching much beyond the middle of the fin, the seventh ray about half the length of the third or longest. Anal rays rapidly shortened behind, the middle rays much shorter than the first long ones. Scales 8–39–6;

B. meridionalis (Günther) Jordan. Mouth small, inferior, slightly corrugated. Depth 3⅓–3¼ in length. Head 4–4½, not much longer than high. Eye rather small, one-fifth of the length of the head and two-fifths that of the snout. Suborbitals narrow. Anterior dorsal rays not much produced, shorter than the head. Caudal forked. Origin of ventral vertically below the fourth dorsal ray. Pectoral fin not extending to ventrals. There are 5 longitudinal series of scales between the lateral line and the root of the ventral. Coloration uniform. Scales 7–38–7; D. 29; A. 10. Rio Usumacinta, Guatemala. (*Günther.*) (*Sclerognathus meridionalis* Günther, vii, 23.)

D. 29; A. 10; V. 10. Coloration paler; the lower fins slightly dusky. Mississippi Valley and southward; generally abundant.

(*Catostomus bubalus* Kirtland, Rep. Zoöl. Ohio, 1838, 168, not of Rafinesque: *Bubalichthys bubalus* Agassiz, Amer. Journ. Sci. Arts, 1855, 195: *Bubalichthys bubalus* Jordan, l. c. 206: *Sclerognathus urus* Günther, vii, 22; *B. altus* Nelson MSS. in Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 73; apparently the oldest tenable name, certainly belonging to the species.)

61.—CARPIODES Rafinesque.

Carp Suckers.

(*Sclerognathus* Valenciennes.)

(Rafinesque, Ichth. Oh. 1820, 56: type *Catostomus cyprinus* Le Sueur.)

Head comparatively short and deep, sometimes conic, sometimes blunt; its length ranging from 3½ to 5 in that of the body; its upper surface always rounded. Eye moderate, median or anterior in position. Suborbital bones well developed, their depth about half that of the fleshy portion of the cheek below. Fontanelle always present, well developed. Mouth always small, horizontal and inferior; the mandible less than one-third the length of the head; the lips thin, the upper protractile, narrow, the lower quite narrow, ∧-shaped, or rather ∩-shaped, behind; both lips feebly plicate or nearly smooth, the plicæ often more or less broken up. Jaws without cartilaginous sheath. Muciferous system moderately developed. Opercular apparatus well developed; the subopercle broad; the operculum in the adult more or less rugose. Isthmus moderate. Pharyngeal bones remarkably thin and laterally compressed, with a shallow furrow along the anterior margin on the inside, and another more central one on the outline of the enlarged surfaces. Teeth very small, compressed, nearly equally thin along the whole inner edge of the bone, forming a fine, comb-like crest of minute serratures; their cutting edge rises above the inner margin into a prominent point. Gill-rakers of anterior arch slender and stiff above, becoming reduced downwards. Body ovate or oblong; the dorsal outline more or less arched; the ventral outline more nearly straight; the depth from half to one-third the length; the sides compressed, the back notably so, forming a sort of carina. Caudal peduncle short and deep. Scales large, about equal over the body, their posterior margins slightly serrate; lateral line well developed, nearly straight, with 34–41 scales; 12–15 scales in a cross-row from dorsal to ventrals. Dorsal fin beginning near the middle of the body, somewhat in advance of ventrals, falcate; its anterior rays elevated and often filamentous, their height ranging from ½ to 1⅓ the length of the base of the fin; the number of

developed rays ranging from 23 to 30. Caudal fin well forked, the lobes equal. Anal fin comparatively long and low, emarginate (in males), its number of developed rays usually 8. Ventrals shortish, with usually 10 rays. Pectorals short. Sexual peculiarities little marked; in some species, at least, the males in spring have the snout minutely tuberculate. Coloration always plain; pale olivaceous above, white below, but hardly silvery, the fins all partaking of the color of the region to which they belong. Air-bladder with two chambers. Size medium or rather large. This genus is very close to *Ictiobus* and *Bubalichthys*. Its species are numerous and very difficult to determine. All belong to the United States. (Latin *carpiodes*, carp-like.)

* Dorsal fin with the anterior rays more or less shortened, their length one-half to two-thirds that of the base of the fin; muzzle more or less conic and projecting.

a. Head short, 4–5 in length.

116. C. carpio (Raf.) Jordan.—*Carp Sucker.*

Head comparatively short, its length contained 4–5 times in the length of the body. Body more fusiform than in the others, compressed, but not much arched, the depth $2\frac{2}{3}$–3 times in the length. Anterior rays of dorsal short, notably thickened and osseous at base, especially in the adult; the first ray nearer the end of the muzzle than the base of the caudal fin, the longest ray a little more than half the base of the fin; caudal moderately forked. Eye medium, anterior, $4\frac{1}{2}$ in head. Muzzle short, but projecting much beyond mouth. D. 30; Lat. l. 36. Size largest of the genus. Mississippi Valley; generally abundant.

(*Catostomus carpio* Rafinesque, Ichth. Oh. 1820, 56; Jordan, l. c. 200: *Carpiodes nummifer* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 484.)

aa. Head intermediate, its length contained about 4 times ($3\frac{3}{4}$–$4\frac{1}{3}$) in that of body; anterior rays of dorsal not thickened at base.

117. C. tumidus B. & G.—*Carp Sucker.*

Body elongate, not much elevated; the depth $2\frac{3}{4}$ in length. Head $3\frac{3}{4}$–4; the muzzle prominent, but rather bluntish. Front scarcely concave above eyes, the profile forming a somewhat uniform curve. Eye small, nearly 6 in head. Anterior rays of dorsal moderately elevated, less than three-fourths the length of the fin; the first ray nearly midway between snout and base of caudal. Caudal lobes blunt; suborbitals narrow, small. Scales 6–37–5; D. 24–27; A. 8; V. 10. Ohio to the Rio Grande and Upper Missouri; common. Distinguished from

the preceding by the much smaller eye. This description is based on specimens from Wabash River.

(*Carpiodes cyprinus** Jordan, l. c. 198: *Carpiodes tumidus* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 28: *Carpiodes damalis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 170: *Carpiodes grayi* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 482.)

118. C. thompsoni Agassiz.—*Lake Carp.*

Body stout, short, the back much arched, the depth $2\frac{1}{2}$ in length. Head 4 to $4\frac{1}{4}$ in length, the muzzle moderately pointed. Dorsal rays considerably elevated, two-thirds as long as base of fin. Eye small, $5\frac{1}{4}$ in head. Tip of lower jaw much in advance of nostrils, maxillary reaching line of orbit. Anterior suborbital large, deep, roundish. Origin of dorsal about midway of body. Scales rather closely imbricated, 8–39 to 41–6; D. 27; A. 7; V. 10. Great Lake region; abundant. Perhaps identical with the preceding.

(Agassiz, Amer. Journ. Sci. Arts, 1855, 191; Jordan, l. c. 198.)

aaa. Head long, about $3\frac{1}{2}$ in length.

119. C. bison Agassiz.

Head long, contained about $3\frac{1}{2}$ times in length to base of caudal. Muzzle elongate-conic, so that the eye is nearly median, the middle of the length of the head falling in front of its posterior margin. Body not much arched, depth 3 in length. Anterior rays of dorsal pretty high, not much shorter than the base of the fin, not thickened at base. Lips well developed. Eye large, $4\frac{1}{2}$ in head. Scales 7–40–5; D. 27; A. 7; V. 10. Mississippi Valley.

(Agassiz, Amer. Journ. Sci. Arts, 1854, 356; Cope, Proc. Amer. Phil. Soc. Phila. 1870, 483; Jordan, l. c. 197.)

** Dorsal fin with the anterior rays very much elevated and attenuated, about equalling, or more usually exceeding, the length of the base of the fin.

120. C. cyprinus† (Le Sueur) Agassiz.—*Quillback; Spear-fish; Sail-fish; Skimback.*

Muzzle conic, projecting, obtusely pointed, tip of the mandible reaching to opposite nostrils; maxillary reaching to opposite front of orbit. Anterior suborbital as deep as long. Head $3\frac{3}{4}$–4 in length. Eye large, $3\frac{1}{2}$–$4\frac{1}{2}$ in length of head. Body much arched above, the depth $2\frac{1}{4}$–$2\frac{1}{2}$ in length. First ray of dorsal usually nearer muzzle than base of

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* The original *Catostomus cyprinus* was described from tributaries of Chesapeake Bay. It cannot be the present species, as the dorsal is described and figured as strongly falcate and the caudal deeply forked. We have seen no specimens from the original locality.

† Possibly two or three species are here included: *velifer*, with the anterior dorsal rays longer than the fin; *cyprinus*, with them somewhat shorter; and *cutisanserinus*, with a blunter snout and the dorsal rays very long.

caudal. Caudal deeply forked, its lobes slender, the upper the longer. Scales 7–37–5; D. 26 or 27. Chesapeake Bay to Mississippi Valley; generally abundant.

(? *Catostomus cyprinus* Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, 91; Günther, vii, 12: *Catostomus velifer* Rafinesque, Ichth. Oh. 1820, 56: *Carpiodes velifer* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 482: *Carpiodes velifer* Jordan, l. c. 196: *Carpiodes cutisanserinus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 481: *Carpiodes cutisanserinus* Jordan, l. c. 196: *Carpiodes selene* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 41.)

121. C. difformis Cope.

Muzzle exceedingly blunt, so that the anterior edge of the mandible is in line with the anterior rim of the orbit, and the maxillary reaches to the anterior edge of the pupil. Anterior suborbital deeper than long. Head $4\frac{1}{4}$ in length. Eye quite large, $3\frac{1}{2}$–4 in head. Body arched, the depth somewhat less than half the length. First ray of dorsal nearer muzzle than base of caudal. Scales 6–35–4; D. 24; A. 8; V. 9. Ohio Valley; not common. Perhaps a deformity of the preceding.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 480; Jordan, l. c. 195.)

62.—CYCLEPTUS Rafinesque.

Black Horse.

(Rafinesque, Journ. Phys. Chim. Hist. Nat. Paris, 1819, 421: type *Cycleptus nigrescens* Raf. = *Catostomus elongatus* Le Sueur.)

Head very small, short and slender, its length contained 6–7 times in that of the body; its upper surface rounded. Eye small, behind the middle of the head; not very high up, its length 6–8 in that of the head. Suborbital bones small and narrow. Fontanelle entirely obliterated by the union of the parietal bones. Mouth small, entirely inferior, overlapped by the projecting snout; the upper lip thick, pendent, covered with 3–5 rows of tubercles, the outer quite large, the inner small; lower lip moderate, formed somewhat as in *Catostomus*, but less full, incised behind. Jaws with rudimentary cartilaginous sheath. Muciferous system not greatly developed. Opercular apparatus not greatly developed; the operculum smooth and narrow. Isthmus moderate. Gill-rakers moderately long, soft. Pharyngeal bones strong; the teeth stout, increasing in size downwards, rather wide apart. Body elongate, moderately compressed, not much elevated; the caudal peduncle long; the greatest depth contained 4–6 times in length. Scales moderate, about equal over the body, not closely imbricated, with wide, exposed surfaces, the number in the lateral line from 55–60, and about 17 in a transverse series from dorsal to ventrals. Edges of scales crenate. Lateral line well developed, nearly straight. Fins rather large, dorsal fin be-

ginning in front of ventrals and ending just before anal, of about 30 rays, strongly falcate in front, the first and second developed rays in length more than half the length of the base of the fin, the rays rapidly shortened to about the eighth, the length of the remaining rays being nearly uniform and all short. Caudal fin large, widely forked, the lobes about equal. Anal fin quite small, low, of 7 or 8 developed rays, scaly at base. Ventrals moderat e, with 10 rays. Pectorals elongate, somewhat fal cate. Sexual peculiarities somewhat marked; the males in spring with black pigment; the head then covered with small tubercles. Air-bladder with two chambers, the anterior short, the posterior elongate. One species known. (*κύκλος*, round; *λεπτὸς*, slender. "The name means small round mouth."—*Rafinesque.*)

122. C. elongatus (Le Sueur) Ag.—*Black Horse; Gourd-seed Sucker; Missouri Sucker; Suckerel.*

Depth 4–5 in length; head 6–8½. Eye small, 6–7 in length of head. Longest dorsal rays a little longer than head. Pectorals rather longer than head. Dorsal rays 30; anal 7 or 8; scales 9–56–7. Coloration very dark, the males almost black. Size large. Length of adult 1½–2½ feet. Mississippi Valley; rather common. A singular and interesting fish.

(*Catostomus elongatus* Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, 103: *Sclerognathus elongatus* Günther, vii, 23; Jordan, l. c. 189.)

63.—PANTOSTEUS Cope.

Hard-headed Suckers.

(Cope, Lieut. Wheeler's Expl. W. 100th Mer. v, 673, 1876: type *Minomus platyrhynchus* Cope.)

Head moderate or rather small, 4–5 times in length of body, flattish and rather broad above, anteriorly somewhat pointed. Eye rather small, usually behind the middle of the head. Suborbital bones narrow, as in *Catostomus*. Bones of head rather thick, the two parietal bones firmly united, entirely obliterating the fontanelle. Mouth rather large, entirely inferior; each jaw with a more or less developed cartilaginous sheath, separable in alcohol, essentially as in *Chondrostoma*, *Acrochilus*, and related genera. Upper lip broad, papillose, with a rather broad, free margin and 2 or more series of tubercles. Lower lip largely developed, with an extensive free margin deeply incised behind, but less so than in *Catostomus*. Pharyngeal bones and teeth essentially as in *Catostomus*. Isthmus quite broad. Body generally elongate, subterete, and little compressed. Scales quite small, 80–105 in the course of the lateral line and 30–35 in a cross-series between dorsal and ventrals, usually more or less reduced in size and crowded forward, as in *Catostomus*.

Lateral line well developed, straightish. Fins generally rather small. First ray of dorsal usually about midway of body, its rays few, 9–12 in number. Ventrals inserted rather under posterior part of dorsal, their rays 10 or 9. Anal short and high, with 7 developed rays. Caudal rather shallow-emarginate. Pectorals well developed. Air-bladder with two chambers. Size rather small. Species numerous in the Rocky Mountain region. (*πᾶν*, all; *οστέον*, bone.)

* Scales moderate, 80–85 in the lateral line.

a. Scales subequal over the body, not reduced forwards.

123. P. plebeius (Baird & Girard) Jordan.

Body rather stout, subfusiform. Head slender, rather short, $4\frac{2}{3}$ in length. Eye 5 in head. Ventrals reaching nearly to vent. Scales small, scarcely crowded anteriorly, 80 in the lateral line, 20–30 in a cross-series. Depth $4\frac{1}{2}$ in length. Dorsal midway between snout and upper caudal rays. Caudal short, emarginate. Color dark brown, faintly mottled; sides with orange in the males. (*Girard.*) Lake Guzman, Mexico.

(*Catostomus plebeius* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 28: *Catostomus plebejus* Günther, vii, 15; Jordan, l. c. 184.)

124. P. delphinus Cope.

"The dorsal outline is arched, the head flat above, not elevated behind and much depressed on the muzzle. The muzzle is wide and does not project beyond the upper lip, which is appressed to its lower face and bears four rows of warts; its smooth commissural part is narrow. On the lower lip the tubercles advance nearly to the commissure; this lip is deeply emarginate posteriorly. The eye enters the length of the head 5 times, $2\frac{1}{2}$ times measuring the muzzle, and twice the interorbital region. Head $4\frac{2}{3}$ times in length to end of caudal basal scales. Scales in 30 longitudinal series, between dorsal and ventral fins. Ventrals remarkably short, extending little more than half way to vent, originating under posterior third of dorsal. Pectorals well separated. Isthmus wide. Color above blackish, with a strong inferior marginal shade on the lower part of the sides, and the lighter tint above; a brown spot just above axilla is cut off from it by a band of the yellow color which covers the belly and head below." (*Cope.*) Probably from Green River.

(*Minomus delphinus* Cope, Hayden's Geol. Surv. Wyom. Terr. 1872, 436.)

125. P. bardus Cope.

This species is distinguished by its very short head and marked coloration, resembling in that respect the *C. guzmaniensis* of Girard; with

this species it has, however, nothing else in common. "Head wide, muzzle not projecting beyond upper lip; latter not pendant, with narrow, smooth commissure and 3 or 4 rows of tubercles. Lower lip deeply incised, tubercular to near inner edge. Eye 5.25 times in length of head, twice in interorbital width. Head 5 times to end of basal caudal scales. Form stout. Body cylindric anteriorly. Dorsal fin nearer end of muzzle than end of caudal scales. Scales of body subequal, in 30 longitudinal rows between dorsal and ventral fins, latter originating beneath hinder border of dorsal, not quite reaching vent. Pectorals well separated. Isthmus wide, narrower than in *M. delphinus*. Color blackish above; a broad olive band from upper part of opercular border along upper half of caudal peduncle, and a broad black band below, narrowing to a line along the middle of the peduncle; below yellowish, a band of the same cutting off a blackish area above the axilla, as in the last species." (*Cope.*) Probably from Green River. This species and the two preceding are not well separated.

(*Minomus bardus* Cope, Hayden's Geol. Surv. Wyom. Terr. 1872, 436.)

aa. Scales very much reduced and crowded anteriorly; upper lip full, pendent; cartilaginous sheaths on jaws well developed, the commissure transverse and abruptly angulate at the corners of the mouth.

126. P. platyrrhynchus Cope.

Body extremely elongate, the depth $5\frac{1}{2}$–7 in length. Head $4\frac{3}{4}$ in length, short and wide, with depressed and expanded muzzle, which considerably overhangs the mouth. Isthmus very wide. Dorsal rays 11; ventral rays 9; scales 15–86–12. Belly and lower fins yellowish, probably red in life. Utah Lake. Perhaps identical with the next.

(*Minomus platyrhynchus* Cope, Proc. Amer. Phil. Soc. Phila. 1874, 134; Jordan, l. c. 183.)

127. P. generosus (Girard) Jordan.

Body moderately elongate, the depth $4\frac{1}{2}$–5 in the length. Head rather short, $4\frac{2}{3}$ in length, not specially broadened; muzzle not greatly overhanging the mouth. Lower lip full, with 4 or 5 rows of tubercles; upper with 2. Isthmus very broad. Head with conspicuous mucous tubes. Lower fins large. Dorsal rays 9 (rarely 10); ventral rays 10 (rarely 9); scales 11 to 14–83 to 87–13 to 15. Light brown above, with dusky spots and clouds; males with the chin and fins red, and a crimson lateral band. Rio Grande to Mojave Desert and Great Basin of Utah; very abundant.

(*Catostomus generosus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 174: *Minomus jarrovii* Cope, Proc. Amer. Phil. Soc. Phila. 1874, 35; Jordan, l. c. 183.)

** Scales very small, 100–105 in the lateral line.

128. P. virescens Cope.

Body elongate, compressed, the caudal peduncle contracted. Head short, wide, 5 in length. Muzzle obtuse, little projecting. Upper lip wide; lower lip full, emarginate. Jaws with well-developed cartilaginous sheaths. Scales much reduced in size forwards. Dorsal rays 10; ventral 9; scales 18–103–16. Color olive; lower surface yellow. Headwaters of Arkansas River.

(Cope, Wheeler's Expl. W. 100th Mer. v, 675, 1876; Jordan, l. c. 182.)

64.—CATOSTOMUS Le Sueur.

Suckers.

(*Hylomyzon* Agassiz; *Acomus* and *Minomus* Girard.)

(Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 89, 1817: type *Cyprinus catostomus* Forster = *Catostomus longirostrum* Le Sueur.)

Head more or less elongate, its length ranging from $3\frac{1}{2}$ to 5 times in that of the body. Eye usually rather small, high up, and median or more or less posterior in position. Suborbital bones narrow, longer than broad, much as in *Moxostoma*. Fontanelle always present, usually widely open, in two species reduced to a narrow slit, but never wholly obliterated. Mouth rather large, always inferior, and sometimes notably so; the upper lip thick, protractile, papillose; the lower lip greatly developed, with a broad free margin, deeply incised behind, so that it forms two lobes, which are often more or less separated. Mandible horizontal, short, not one-third the length of the head and not reaching to opposite the eye. Lower jaw usually without distinct cartilaginous sheath. Opercular apparatus moderately developed, not rugose. Pharyngeal bones moderately strong, the teeth shortish, vertically compressed, rapidly diminishing in size upwards, the upper surface of the teeth nearly even or somewhat cuspidate. Body oblong or elongate, more or less fusiform, subterete, more or less compressed. Scales comparatively small, typically much smaller and crowded anteriorly, the number in the lateral line ranging from about 50 to 115, the number in a transverse series between dorsal and ventrals from 15 to 40. Lateral line well developed, straightish, somewhat decurved anteriorly. Fins variously developed. Dorsal with its first ray nearly midway of the body, with from 9 to 14 developed rays. Anal fin short and high, with probably always 7 developed rays. Ventrals inserted under the middle or posterior part of the dorsal, typically with 10 rays; in one subgenus usually 9; the number often subject to variation of one. Caudal fin usually deeply forked, the lobes nearly equal. Sexual peculiarities not much

marked; the fins higher in the male and the anal somewhat swollen and tuberculate in the spring. Breeding males in some species with a rosy or orange lateral band. Air-bladder with two chambers. Vertebræ in *C. commersoni* and *C. nigricans* 45–47. Species very numerous, all belonging to the United States, except the Siberian *C. rostratus* Tilesius. (κάτω, inferior; στόμα, mouth.)

* Scales very small, much reduced and crowded anteriorly, 83–115 in the lateral line. (*Catostomus.*)

a. Fontanelle almost obliterated, reduced to a narrow slit; each jaw with a well-developed cartilaginous sheath (as in *Pantosteus*).

129. C. discobolus Cope.

Body subterete, compressed behind, the depth 5 in length. Interorbital space 2 in head. Head quite short, broad and rounded above, $4\frac{3}{4}$ in length. Eye small, far back and high up, 6 in head. Mouth very large, inferior, beneath the projecting snout. Upper lip very full, pendent, with about 5 rows of tubercles. Lower lip very full, moderately incised, with about 10 rows, a notch separating the upper lip from the lower. Each jaw with a slightly curved cartilaginous sheath on its edge, the two parallel with each other and fitting closely together. Fins small. Dorsal 11; caudal little forked; scales 15–90–11, irregular. Colors dusky. Size small. Idaho to Wyoming and Arizona.

(Cope, Hayden's Geol. Surv. Wyom. Terr. 1870, 435; Jordan, l. c. 179.)

aa. Fontanelle well developed; jaws without evident cartilaginous sheath.
b. Upper lip very broad, with several (5 or 6) rows of large papillæ.

130. C. latipinnis Baird & Girard.

Body slender and elongate; the caudal peduncle especially long and very slender; the depth $5\frac{1}{4}$ in the length. Head moderate, $4\frac{3}{4}$ in length, rather slender, with prominent snout and rather contracted, inferior mouth. Outline of the mouth triangular, the apex forwards. The lips very thick, greatly developed; lower lip incised to the base; its posterior margin extending backwards to opposite the eye. Jaws with a slight cartilaginous pellicle. Eye small, high up. Preorbital bone broad, scarcely twice as long as deep. Scales long and low, posteriorly rounded, their horizontal diameter greater than the vertical, 17–98 to 105–17. Fins excessively developed, especially in the males, the free border of the dorsal deeply incised. Height of each of the three vertical fins in the males greater than the length of the head. Dorsal 13, inserted nearer snout than base of caudal. Caudal very strong, the rudimentary rays at its base unusually developed. Least depth of tail less

than one-third the head. Coloration silvery; the males probably rosy and tuberculate in spring. Gila region to Wyoming; not abundant.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 388; Günther, vii, 14; Jordan, l. c. 178: *?? Catostomus guzmaniensis** Girard, Proc. Acad. Nat. Sci. Phila. 1856, 173.)

131. C. retropinnis Jordan.

Body long and slender, subterete, compressed behind, the form essentially that of *C. longirostris*, the depth contained $5\frac{1}{2}$ times in the length. Head large, 4 in length of body, the interorbital space broad and flat, $2\frac{1}{2}$ in length of head. Eye small, high up and rather posterior. Preorbital bone very long and slender, its length about 3 times its depth. Mouth large, precisely as in *C. latipinnis*, the upper lip pendent, very large, with 5–8 series of tubercles. Dorsal fin not elongated or especially elevated, its rays 11, the beginning of the dorsal much nearer base of caudal than snout. Caudal fin long and strongly forked. Anal fin long and high, reaching base of caudal. Ventrals not reaching vent. Caudal peduncle stout and deep, its least depth more than one-third length of head; its length about two-thirds that of head. Scales quite small, about as in *longirostris*, the exposed portion not notably lengthened. Chest with well-developed scales. Scales 16–100–14. Coloration dusky brown, a dusky lateral band, pale below, the dark colors extending low. Snout quite dark. Size large. Montana to Nebraska.

(Jordan, l. c. 178.)

bb. Upper lip comparatively thin and narrow, with but few (3 or 4) rows of papillæ.

132. C. longirostris Le Sueur.—*Long-nosed Sucker; Northern Sucker.*

Body elongate, subterete, the depth $4\frac{1}{4}$–$4\frac{3}{4}$ in length. Head quite long and slender, $4\frac{1}{4}$–$4\frac{2}{3}$ in length, depressed and flattened above, broad at base, but tapering into a long snout, which considerably overhangs the large mouth. Lips thick, coarsely tuberculate, the upper lip narrow, with 2 or 3 rows of tubercles. Eye rather small, behind the middle of the head. Scales very small, much crowded forwards, 95–114 in the course of the lateral line, and about 29 (26–31) in a cross-row from dorsal to ventrals. Dorsal rays 10 or 11. Males in spring with the head and anal fin profusely tuberculate, the tubercles on the head small; the sides at that season with a broad rosy band. Size large; the largest species in the genus. Great Lakes and Upper Mississippi Valley to

* This is probably a distinct species. It is stouter than *C. latipinnis*, with shorter and deeper caudal peduncle and lower fins. A blackish lateral band. D. 12; Lat. l. about 90. Upper lip with 4 rows of papillæ. The original type from Lake Guzman, Chihuahua, is now lost.

Alaska; very abundant northward. The most widely distributed species.

(*Cyprinus catostomus* Forster, Phil. Trans. 1773, 155: *Catostomus longirostrum* and *hudsonius* Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, 102, 107: *Catostomus forsterianus* Richardson, Franklin's Journal, 1823, 720: *Catostomus aurora* Agassiz, Lake Superior, 360: *Catostomus hudsonius* Günther, vii, 13: *Catostomus griseus* Günther, vii, 14; Jordan, l. c. 175.)

133. C. tahoensis Gill & Jordan.—*Tahoe Sucker.*

Rather stouter, the depth 4½–5 in length. Head very large and long-acuminate, the muzzle nearly one-half its length, overhanging the rather large mouth. Lips moderate, the upper pendent, with about 3 rows of small papillæ; the lower rather full, similarly papillose. Eye nearly median, rather small, 8½ in head. Scales small and crowded forwards, closely imbricated, 85–90 in the course of the lateral line, and about 28 in a cross-series from dorsal to ventrals. Dorsal short, but longer than high, its rays 10. Coloration very dark; fins dusky; scales everywhere finely punctate. Breeding males profusely tuberculate. Size large. Lake Tahoe; very abundant.

(Jordan, l. c. 173; Jordan & Henshaw, Rept. Chief Engin. app. *nn*, 1878, 188.)

** Scales small, crowded, and smaller anteriorly than posteriorly, 58–75 in the course of the lateral line. (*Decactylus* Rafinesque.*)

c. Upper lip thick and full, with several (5–8) rows of papillæ.

d. Fontanelle very small and narrow; both jaws with a weak cartilaginous sheath.

134. C. araxopus Jordan.

Body elongate, fusiform, subterete, the greatest depth 4¼–4½ in length. Head small, conical, 4⅔ in length. Mouth quite large, with full, thick lips, the upper very wide and pendent, with about 6 rows of very strong papillæ; lower lip two-lobed, similarly papillose. Interorbital space wide, convex. Eye elevated, posterior, quite small. Fins moderate; dorsal higher than long, with 10, rarely 11, rays; ventral rays 10. Scales small, crowded forwards, 10 or 9–70–8. Color dark; scales with dark punctulations. Nevada and Southern California.

(Jordan, l. c. 173; Jordan & Henshaw, Rept. Chief Engin. app. *nn*, 1878, 188.)

dd. Fontanelle well developed; lips without evident cartilaginous sheath.

e. Lateral line with 70–80 scales.

135. C. labiatus Ayres.

Head 4⅛ in length, rather bluntish. Mouth moderate, the labial papillæ largely developed; the upper lip full, with about 5 rows of large

* Rafinesque, Ichth. Oh. 1820, 60: type *Catostomus bostoniensis* Le Sueur. (δεκα, ten; δακτυλος, toes; *i. e.*, 10 ventral rays.)

but rather sparse papillæ. Scales 12–74–10. Dorsal fin short, higher than long, of about 11 rays. Color dark above; sides clouded with black and yellow. Klamath Lake, Oregon. A little-known species.

(Ayres, Proc. Acad. Nat. Sci. Cal. 1855, 32; Jordan, l. c. 173.)

136. C. macrochilus Grd.—*Columbia River Sucker.*

Body heavy forwards. Head large and heavy, convex. Snout blunt, much overlapping the horizontal mouth. Mouth quite large, with very large lips, the upper full and pendent, with 6–8 rows of strong papillæ. Head large, 4¼ in length, rather narrow, quadrangular, the snout projecting. Eye large. Dorsal fin much longer than high, its rays about 15. Pectorals long and narrow; caudal well forked. Head 4 in length. Scales 12–72–10. Coloration rather dark; a dusky lateral stripe; below abruptly pale. Columbia River.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 175; Jordan, l. c. 171.)

137. C. occidentalis Ayres.—*Sacramento Sucker.*

Body rather slender, little elevated. Mouth comparatively small, smaller than in *C. commersoni;* the upper lip with 5 or 6 rows of smallish papillæ; lips rather thin. Head quite small, rounded above, 4½ in length, the profile steeper than in *C. commersoni*, the snout more pointed, the two sides of the head more convergent forwards. Eye small. Dorsal fin longer than high, its rays 12–14; caudal well forked, the upper lobe the longer. Scales 13–75–10. Dark above, gradually paler below. Streams of California; abundant in the Sacramento and San Joaquin.

(Ayres, Proc. Cal. Acad. Nat. Hist. 1854, 18; Jordan, l. c. 172.)

138. C. bernardini Girard.

Color blackish. Fins rather high. Lateral line with 80 scales (according to the figure). Eye large. Head 5 in length. Mouth small, with broad lips. Rio Huagui, Mexico, west of the Sierra Madre. (*Girard.*) This species is, perhaps, allied to *C. occidentalis*, but may be a *Pantosteus.*

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 175.)

ee. Lateral line with 60–65 scales.

139. C. ardens Jor. & Gilb.

Body rather elongate, little compressed, the back broad. Head broad, conical. Mouth entirely inferior, the mandible horizontal; upper lip very wide, full, pendent with about 8 rows of coarse, irregular papillæ; lower lip very broad, coarsely papillose, cut to the base by a sharp incision. Eye very small, 7 in head, 3½ in interorbital width. Dorsal fin long and low, its anterior rays three-fourths the base of the fin, half

longer than the last rays; pectorals and ventrals short; caudal short; anal long. Pharyngeal bones rather weak, with smallish teeth. Blackish above; males with the sides rosy; fins dark. Head $3\frac{2}{3}$; depth $4\frac{1}{2}$. D. 13; A. 7; scales 9–65–9. L. 18 inches. Utah Lake.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. iii, 464, 1880.)

140. C. fecundus Cope & Yarrow.—*Utah Lake Sucker.*

Body moderately stout, little compressed, the tail slender. Head subconic, the profile regularly decurved from the nape to the base of the premaxillary spines, which abruptly protrude, forming a distinct "nose" as in *Chasmistes liorus;* premaxillaries in front scarcely below the preorbital. Mandible large, oblique, placed at an angle of 30° when the mouth is closed, its length 3 in head. Upper lip full, pendent, with about 4 rows of coarse papillæ; lower lip moderate, divided by a broad notch, each lobe with about 6 rows of papillæ. Eye a little behind middle of head. First ray of dorsal twice height of the last, its length greater than that of the base of the fin; caudal forked, the lower lobe longest; pectorals long; anal high. Dusky above, pale below. Head 4; depth $4\frac{1}{2}$. D. 11; A. 7; V. 9; scales 8–60–8. L. 13 inches. Utah Lake; excessively abundant. This species has evident affinities with *Chasmistes.*

(Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. v, 678, 1876; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 463.)

cc. Upper lip comparatively thin, with but few (2 or 3) rows of papillæ.

f. Scales much reduced, and crowded anteriorly; dorsal rays 11-15.

141. C. cypho Lockington.

A conspicuous hump behind the occiput, supported by a greatly expanded, broadly triangular interneural bone. Upper lip with about 3 rows of papillæ, lower lip with about 8; the lower lip divided to the base by a broad emargination. D. 15; A. 8; V. 10; Lat. l. 72. Colorado River at mouth of Gila. (*Lockington.*)

(Lockington, Proc. Acad. Nat. Sci. Phila. 1880.)

142. C. commersoni (Lacépède) Jordan.—*Common Sucker; White Sucker; Brook Sucker; Fine-scaled Sucker.*

Body moderately stout, varying with age, subterete, heavy at the shoulders, the depth $4–4\frac{2}{3}$ in length. Head rather large and stout, conical, flattish above, its length $4–4\frac{1}{2}$ in body ($3\frac{1}{2}–4\frac{1}{4}$ in young). Snout moderately prominent, scarcely overpassing the mouth. Mouth rather large; the lips strongly papillose, the upper moderate, with 2 or 3 rows of papillæ. Scales crowded anteriorly, much larger on the sides than below; scales 10–64 to 70–9. Coloration olivaceous; males in

spring with a faint rosy lateral band; young brownish, more or less mottled, often with confluent blackish lateral blotches or a lateral band. Lateral line usually imperfect in the young. L. 18 inches. All streams from Labrador to Montana, and southward to Florida. The commonest of the suckers.

(*Cyprinus commersoni* Lacépède, Hist. Nat. Poiss. v, 502, 1803: *Cyprinus teres* Mitchill, Trans. Lit. & Phil. Soc. N. Y. 1814, 458: *Catostomus teres* Günther, vii, 15: *Catostomus teres* Jordan, l. c. 166: *Catostomus communis* and *bostoniensis* Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, 95, 106, etc.)

ff. Scales scarcely reduced or crowded anteriorly; dorsal rays 10 or 11.

143. C. insignis Baird & Girard.

Body rather elongate, subterete, heavy at the shoulders, tapering backward, the depth about 5 in length. Head moderate, about 4½ in length. Mouth comparatively small. Lips moderate, the upper narrow, with about 2 rows of large tubercles. Scales subequal, 58–63 in the lateral line, 19 in a cross-series. A series of dusky spots along each row of scales, the spots often obscure. Gila Basin.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 28; Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. v, 676, 1876; Jordan, l. c. 165.)

144. C. clarki Baird & Girard.

Body moderately stout, depth 4⅔ in length. Head very small and short, about 5 in length. Eye moderate. Fins all notably small. Scales small, subequal, 9–70–9; larger mesially than posteriorly. Body with scattered nebulous spots. (*Girard.*) Arizona.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 27.)

***** Scales moderate, not crowded anteriorly, 48–55 in the lateral line; head peculiarly formed. (*Hypentelium* Rafinesque.*)

145. C. nigricans Le Sueur.—*Hog Sucker; Stone Roller; Toter; Crawl-a-bottom; Hammer-head; Stone Lugger; Hog Molly.*

Head flattened above, transversely concave between the orbits, the frontal bone thick, broad, and short, the physiognomy being therefore peculiar. Ventral rays normally 9. Upper lip very thick, strongly papillose, with a broad, free margin, which has upwards of 8–10 series of papillæ upon it; lower lip greatly developed, strongly papillose, considerably incised behind, but less so than in *Catostomus* proper. Fontanelle shorter and smaller than in *C. commersoni*. Pectoral fins unusually large. D. 10 or 11; Lat. l. 48–55; 12–15 scales in a cross-

* Rafinesque, Journ. Acad. Nat. Sci. Phila. 1818, 421: type *Exoglossum macropterum* Raf. = *Catostomus nigricans* Le Sueur. (ἰπὸ, below; πέντη, five; labium, lip, the five-lobed lower lip being supposed to distinguish it from *Exoglossum.*) (= *Hylomyzon* Ag.)

series. Depth 4½–5 in length; head 4–4½. Eye rather small, 4½ to 5 in head. Color olivaceous; sides with brassy lustre; belly white; back brown, with several dark cross-blotches, irregularly arranged, these becoming obsolete in old individuals; lower fins dull red, with some dusky shading; young considerably variegated, the sides spotted. Size large; maximum length about 2 feet. New York to Alabama and Kansas; abundant. Ascends streams to spawn early in spring.

(Le Sueur, Journ. Acad. Nat. Sci. Phila. 1818, 102: *Hylomyzon nigricans* Agassiz, Amer. Journ. Sci. Arts, 1855, 205; Günther, vii, 17; Jordan, l. c. 162.)

65.—CHASMISTES Jordan.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, No. 2, 417, 1878: type *Chasmistes liorus* Jor.)

Head disproportionally large, forming more than one-fourth of length, broad and flattish above; sides of head vertical, slightly directed inwards, the breadth through the cheeks less than the breadth above the eyes. Eyes small, high up, rather posterior. Mouth extremely large, terminal, the lower jaw in the closed mouth being very oblique, placed at an angle of about 45 degrees. The lower jaw very long and strong, its length more than one-third the length of the head, nearly half the length of the head in the adult, its tip, when the mouth is closed, about on a level with the eye. Upper jaw very protractile. Upper lip very thin (for a sucker), and nearly smooth. Snout elevated above the rest of the head, the premaxillary spines usually forming a conspicuous nose. Lower lip moderate, consisting of a broad flap on each side of the mandible, in front reduced to a narrow rim, the surface of the lip nearly smooth, without papillæ. Nostrils large. Suborbital bones narrow, but rather broader than in *Catostomus*. Preorbital unusually large. Mucous channels moderately developed. Fontanelle very large. Isthmus rather narrow Pharyngeal bones weaker than usual in *Catostomus*, the teeth generally smaller. Body rather slender, tapering pretty regularly from the shoulders to the tail, but little compressed. Caudal peduncle rather stout. Fins moderate; the dorsal rays about 12; the anal 7. Pectorals rather long, not quite reaching ventrals; ventrals reaching vent; anal fin high, reaching caudal; caudal fin rather long, its lobes equal. Scales moderate, large on the caudal peduncle, much smaller and crowded anteriorly, 60–65 in the lateral line, about 18 in a transverse series from dorsal to ventrals. Sexual peculiarities unknown. Coloration usual. Air-bladder in two parts. Size moderate or rather large. (*χασμάω*, to yawn.)

a. Pharyngeal bones of moderate strength; the upper teeth minute, the lower enlarged. (*Chasmistes.*)

146. C. liorus Jordan.—*June Sucker of Utah Lake.*

Depth about 5 in length; head $3\frac{2}{3}$. Interorbital space broad, $2\frac{1}{4}$ in head. Eye 6–7 in head. Width of the open mouth $3\frac{1}{2}$ in head. D. I, 11, the fin elevated in front, its anterior ray twice the height of the posterior and about equal to the base of the fin; A. I, 7; caudal deeply forked, the lower lobe long; lower fins small. Scales 9–63–8. Color dusky above, pale below; the scales of the back and sides profusely covered with dark punctulations. L. 18 inches. Utah Lake; abundant.

(Jordan, Bull. U. S. Nat. Mus. xii, 219, 1878.)

aa. "Pharyngeal bones very thin and flat, with very numerous minute teeth, as in *Carpiodes.*" (*Lipomyzon* Cope.*)

147. C. brevirostris Cope.

"Shorter than *C. luxatus*, especially the muzzle, and the latter is without the hump produced by the protuberant premaxillary spines. Parietal fontanelle small. The lower lip fold is only present on the sides of the mandible. Body nearly cylindric. Scales 12–74–11. Radii: D. 11; A. 9. Color dusky above, silvery below; fins colorless." (*Cope.*) L. 16 inches. Klamath Lake, Oregon.

(Cope, American Naturalist, 1879, 785.)

148. C. luxatus Cope.

"Form elongate. Head long, flat above, and with a large fontanelle. Mouth terminal, the spines of the premaxillary projecting so as to form a hump on the top of the snout. Lower lip a very thin dermal fold, extending entirely around the chin. Scales 12–80–9. Radii: D. 11; A. 9. Color clouded above, with black punctulations, below paler, with red shades in some specimens; fins uncolored." (*Cope.*) L. 3 feet. Klamath Lake and River.

(Cope, American Naturalist, 1879, 784.)

66.—ERIMYZON Jordan.

Chub Suckers.

(*Moxostoma* Ag.; not of Raf.)

(Jordan, Bull. Buffalo Soc. Nat. Hist. 1876, 95: type *Cyprinus oblongus* Mitch. = *Cyprinus sucetta* Lac.)

Body oblong, rather shortened, heavy forwards, and considerably compressed. Head moderate, rather broad above. Mouth moderate,

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*Cope, Amer. Nat. Jan. 1881, 59: type *Chasmistes brevirostris* Cope. (λείπω, to be deficient; μύζω, to suck.)

somewhat inferior; the upper lip well developed, freely protractile; the lower moderate, infolded, ∧-shaped in outline, plicate, with 12–20 plicæ on each side. Lower jaw without cartilaginous sheath, rather stronger than usual, and oblique in position when the mouth is closed, thus similar to the mouth of *Ictiobus*. Eye moderate, rather high up, placed about midway of the head. Suborbital bones considerably developed, not very much narrower than the fleshy portion of the check below them; the posterior suborbital concavo-convex, about twice as long as deep, sometimes divided; the anterior somewhat deeper than long, sometimes divided into two, sometimes united with the preorbital bone, which is well developed, and much longer than broad. Opercular bones moderately developed, scarcely or not rugose. Fontanelle rather large. Gill-rakers rather long. Isthmus moderate. Pharyngeal bones weak; the teeth quite small, slender, and weak, rapidly diminishing in length upwards, each tooth narrowly compressed, with a cusp on the inner margin of the cutting surface, and some inequalities besides. Scales rather large, more or less crowded forwards, sometimes showing irregularities of arrangement; the longitudinal radiating furrows much stronger than usual; the scales rather longer than deep, but so imbricated in the adult that the exposed surfaces appear deeper than long. Lateral line entirely wanting. Scales in the longitudinal series from head to base of caudal 35–45 in number; scales in transverse row from base of ventral to dorsal 12–18. Dorsal fin rather short and high, with 10–14 developed rays, the number usually 11 or 12. Beginning of dorsal fin rather nearer snout than base of caudal. Pectoral fins moderate, not reaching ventrals; the latter not to vent. Ventrals under a point rather in advance of the middle of dorsal; their rays normally 9, but occasionally 8 or 10. Anal fin high and short, more or less emarginate or bilobed in adult males. Caudal fin moderately forked or merely lunate, its two lobes about equal. Air-bladder with two chambers. Two species known. (ἔρι, an intensive particle; μύζω, to suck.)

149. E. sucetta (Lac.) Jordan.—*Creek Fish; Chub Sucker.*

Body oblong, compressed, becoming gibbous with age, the ante-dorsal region more or less elevated in the adults, the depth $3\frac{1}{4}$ in length, ranging from $2\frac{3}{4}$ in adults to 4 in young. Head stout, short, about $4\frac{1}{4}$ in length ($4–4\frac{1}{2}$), the interorbital space wide and depressed, the lower parts narrower. Eye not large, $4\frac{3}{4}$ in head ($4\frac{1}{2}–5\frac{1}{2}$). Mouth protractile downwards and forwards, the mandible oblique. Scales usually closely imbricated

and more or less crowded forwards, but often showing various irregularities in arrangement, about 43 (39–45) in a longitudinal series and 15 (14–16) in a transverse series between the ventrals and the dorsal. Fin-rays somewhat variable, the dorsal with 11 (10–13) developed rays, the anal with 7, and the ventrals with 9 (rarely 8). Coloration varying with age; never distinct series of black spots along the rows of scales. Young with a broad black lateral band, bordered above by paler. In some specimens from clear water this band is of a jet-black color and very distinct; in others it is duller. Later this band becomes broken into a series of blotches, which often assume the form of broad transverse bars. In adult specimens these bars disappear, and the color is nearly uniform brown, dusky above, paler below, everywhere with a coppery or brassy, never silvery, lustre. The fins are dusky or smoky brown, rarely reddish-tinged. Sexual differences strong. The males in spring with usually three large tubercles on each side of the snout, and with the anal fin more or less swollen and emarginate. Adult specimens with the back gibbous and the body strongly compressed, in appearance quite unlike the young. Maximum length about 10 inches. New England to the Rocky Mountains, south to Texas; very abundant.

(*Cyprinus sucetta* Lac. Hist. Nat. Poiss. v, 606, 1803: *Cyprinus oblongus* Mitch. Trans. Lit. & Phil. Soc. i, 459, 1814: *Moxostoma oblongum* Günther, vii, 21: *Catostomus gibbosus* Storer, Fish Mass. 291; Jordan, Man. Vert. 319; Jordan, Bull. U. S. Nat. Mus. xii, 144.)

150. E. goodei Jordan.

Body oblong, the back more elevated, the body deeper and more compressed than in the preceding, the greatest depth in advance of the dorsal fin being contained about $2\frac{3}{4}$ times in the length. Nape less gibbous than in *E. sucetta*. Head quite small and short, the large eye being almost exactly midway in its length. Its length $4\frac{1}{2}$ in that of the body. Eye $4\frac{1}{4}$ in head. Interorbital space rather narrow, transversely convex, less than half the length of the head. Mouth small, protractile forwards, the lower jaw oblique; lips as in the preceding. Scales large, much larger and much more uniform in their imbrication than in *E. sucetta*, 36 in a longitudinal series, and about 13 in a transverse series from the ventrals to the dorsal. Dorsal fin high, of 12 developed rays; anal moderate, with 7; ventrals large, with 10. Color dark olivaceous above; each scale along the sides reflecting pale from the strongly striated middle part, these giving in cer-

tain lights the appearance of pale stripes along the rows of scales; fins dusky, especially at their tips. Rivers of Florida.

(Jordan, Bull. U. S. Nat. Mus. xii, 148, 1878.)

67.—MINYTREMA Jordan.

Spotted Suckers.

(Jordan, Man. Vert. E. U. S. ed. 2, 318: type *Catostomus melanops* Raf.)

Head moderate, rather broad above. Mouth moderate, inferior, horizontal; the upper lip well developed, freely protractile; the lower rather small, infolded, ∧-shaped in outline, plicate, with 12–20 plicæ on each side. Lower jaw without cartilaginous sheath. Eye moderate, rather high, placed about midway of the head. Suborbital bones considerably developed, not very much narrower than the fleshy portion of the cheek below them; the posterior suborbital concavo-convex, about twice as long as deep, sometimes divided; the anterior somewhat deeper than long, often divided into two, sometimes united with the preorbital, which is well developed and much longer than broad. The number and form of these bones, except as to their depth, are not constant in the same species, and do not afford specific characters. Opercular bones well developed, not much rugose. Fontanelle evident, rather large. Gill-rakers rather long, in length about half the diameter of the eye. Isthmus moderate. Pharyngeal bones essentially as in *Moxostoma*. Body rather elongate, subterete, becoming deep and rather compressed with age. Scales rather large, nearly equal over the body, the radiating furrows not specially marked. Lateral line interrupted in the adult, but with perfect tubes, imperfect in partly grown specimens, entirely obsolete in the young. Scales in a longitudinal series 44–47 in number, 12–14 in a transverse series from dorsal to ventrals. Dorsal fin rather short and high, with about 12 developed rays, beginning rather nearer the snout than the base of the caudal. Pectoral fins moderate, not reaching ventrals, the latter not to vent. Ventrals rather in advance of the middle of the dorsal, their rays normally 9, rarely 8 or 10. Anal fin high and short, often more or less emarginate in males. Caudal fin moderately forked, the lobes about equal. Air-bladder with two chambers. Males in spring with the head covered with many small tubercles. One species certainly known.* (μινυς, reduced; τρῆμα, aperture; in allusion to the imperfections of the lateral line.)

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* *M. austrinum* Bean. Body rather stout, the depth 4 in length. Head 4⅓ in length. Lips plicate, truncate behind. Light brown above, yellowish below; some scales brownish at base. Paired fins with dark blotches. D. 11; A. 6; scales 6–44–6. Michoacan, Mexico (west of Sierra Madre). This species is probably a *Minytrema*, but the air-bladder has been removed from the typical specimens.

(*Myxostoma austrina* Bean, Proc. U. S. Nat. Mus. 1879, 302.)

151. M. melanops (Raf.) Jordan.—*Spotted Mullet; Striped Sucker.*

Body oblong, little compressed, the young nearly terete, the adults deeper bodied; the dorsal region not elevated. Depth about 4 in length, varying from about 3 in adults to $4\frac{1}{2}$ in the young. Head not very large, $4\frac{1}{3}$ in length of body ($4\frac{1}{4}$–$4\frac{1}{2}$), not specially depressed. Mucous pores rather strong. Eye small, 5–6 in head. Mouth quite inferior, horizontal, rather small. Scales large, firm, regularly and smoothly imbricated, in 46 (44–47) longitudinal series and 13 (12–14) transverse series, the scales not crowded forwards. Fin-rays usually: D. 12; A. 7; V. 9. Coloration dusky above, with usually a black blotch behind the dorsal fin. Each scale along the sides with a small, more or less distinct blackish spot at its base, these spots forming interrupted longitudinal lines along the rows of scales. These lines are usually very distinct, especially in the adult, but young specimens often show them faintly. Sides and belly silvery, with a coppery lustre. Sexual peculiarities moderately marked; very old males with the head covered with small tubercles in spring. No great changes with age, either in form or coloration. Size large; maximum length about 18 inches. Great Lake region to South Carolina and Texas.

(*Catostomus melanops* Raf. Ichth. Oh. 1820, 57: *Catostomus fasciatus* Günther, vii, 19; Jordan, Man. Vert. 318; Jordan, Bull. U. S. Nat. Mus. xii, 138.)

68.—MOXOSTOMA Rafinesque.

Red Horse.

(*Ptychostomus* Ag.; *Teretulus* Raf.)

(Rafinesque, Ichth. Oh. 1820, 54: type *Catostomus anisurus* Raf.)

Body more or less elongate, sometimes nearly terete, usually more or less compressed. Head variously long or short, its length ranging from $3\frac{1}{2}$ to $5\frac{1}{2}$ in that of the body. Eye usually rather large, varying from 3 to 6 times in the length of the side of the head, its position high up and median or rather posterior. Suborbital bones very narrow, always much longer than broad, their width less than one-fourth that of the fleshy part of the cheek. Fontanelle on top of head always well open, the parietal bones not coalescing. Mouth varying much in size, always inferior in position, the mandible being horizontal or nearly so. Lips usually well developed, the form of the lower varying in different sections of the genus, usually with a slight median fissure, but never deeply incised; the lips with transverse plicæ, the folds rarely so broken up as to form papillæ. Jaws without conspicuous cartilaginous

sheath. Muciferous system considerably developed, a chain of tubes along the supraorbital region, a branch of which extends around behind the eye and forwards along the suborbital bones and the lower edge of the preorbital. Opercular bones moderately developed, nearly smooth. Isthmus broad. Gill-rakers weak, moderately long. Pharyngeal bones rather weak, much as in *Erimyzon* and *Catostomus*, the teeth rather coarser, strongly compressed, the lower 5 or 6 much stronger than the others, which are rapidly diminished in size upwards, each with a prominent internal cusp. Scales large, more or less quadrate in form, nearly equal in size over the body, and not specially crowded anywhere, usually about 44 in the lateral line (41–56) and about 12 series between dorsal and ventrals. Lateral line well developed, straight or anteriorly curved. Fins well developed, the dorsal inserted about midway of the body, its first rays usually rather nearer snout than the caudal, the number of developed rays usually about 13, but varying in different species from 11 to 17. Anal fin short and high, usually emarginate in the male fish, probably always with 7 developed rays. Ventrals inserted nearly under the middle of the dorsal; their number of rays normally 9, occasionally varying to 10; the occurrence of 10 ventral rays is probably an accidental individual character, and not a permanent specific one. Caudal fin deeply forked, the lobes about equal, except in two species. Air-bladder with three chambers. Skeleton essentially as in *Catostomus*, the vertebræ in *M. carpio* 27–14. Sexual peculiarities little marked, the males in the spawning season with the lower fins reddened, and the anal rays swollen and somewhat tuberculate. Species very numerous in the United States east of the Rocky Mountains. They spawn in spring, running up from the rivers into the smaller streams for that purpose. They are difficult to distinguish, and have perhaps been unduly multiplied by authors. (*μύξω*, to suck; *στόμα*, mouth; hence, more properly *Myxostoma*.)

* Lips full, strongly papillose.

152. M. papillosum (Cope) Jordan.

Body comparatively stout, the dorsal region somewhat elevated and rounded, the depth being about 4 in length, the head about the same. Eye rather large, high up and well back, the preorbital space being longer than the other species. Top of head flat. Dorsal rays 12–14. Scales rather large, 6–42–5. Lips well developed, deeply incised.

Color silvery; back with smoky shading; lower fins white. Size large; reaches a length of about 2 feet. North Carolina to Georgia.

(*Ptychostomus papillosus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 470; Jordan, Man. Vert, 318; Jordan, Bull. U. S. Nat. Mus. xii, 134.)

** Lips distinctly plicate.

† Lower lip infolded, Λ-shaped when viewed from below, with a distinct median crease, in which the two halves of the lip meet, forming an acute angle; mouth small.

a. Dorsal large, with 15–17 developed rays.

153. M. velatum (Cope) Jordan.

Body stout, deep, compressed, the back elevated, the depth 3–4 in length. Head short, heavy, flattish and broad above, $3\frac{3}{4}$–$4\frac{1}{4}$ in length. Depth of cheeks half the length of the head. Eye rather large, midway in head, 4–5 in its length. Muzzle rather prominent, bluntish, overhanging the very small mouth. Fins very large. Dorsal long and high, its height five-sixths the length of the head, its free border straight. Pectorals nearly reaching ventrals. Color silvery; smoky above; lower fins red. Size large. Upper Mississippi Valley to Georgia and southward.

(*Ptychostomus velatus* and *collapsus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 471–472; Jordan, Man. Vert. 317; Jordan, Bull. U. S. Nat. Mus. xii, 132.)

aa. Dorsal moderate, with 12–14 developed rays.

b. Head comparatively large, about 4 in length; dorsal rays usually 12.

154. M. bucco (Cope) Jordan.

Head short and very wide through the opercles, flat above. Body stout, the back somewhat elevated, depth 4 in length. Muzzle subtruncate, slightly projecting. Scales 6–40–5. Olivaceous silvery below; dorsal fin dusky. Kansas. (*Cope.*)

(*Ptychostomus bucco* Cope, Hayden's Geol. Surv. Wyom. 1872, 437: *Myxostoma congestum* Jordan, Bull. U. S. Nat. Mus. xii, 133; probably not *Catostomus congestus* B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 27, which Professor Cope thinks is a form of *M. macrolepidotum*, he having obtained it in Texas and Arizona.)

155. M. pidiense (Cope) Jordan.

Head rather long, $4\frac{1}{2}$ in length, flattish above. Body elongate, more nearly cylindrical, little compressed. Muzzle truncate. Olivaceous, sometimes with rows of faint spots along the series of scales. Dorsal and caudal fins black-edged. Size quite small. Resembles *M. cervinum*, but the mouth entirely different. Great Pedee River. (*Cope.*)

(*Ptychostomus pidiensis*, Proc. Am. Phil. Soc. Phila. 1870, 471; Jordan, Man. Vert. 317; Jordan, Bull. U. S. Nat. Mus. xii, 133.)

bb. Head very small, about 5 in length.

156. M. coregonus (Cope) Jordan.—*Blue Mullet.*

Muzzle conic, much projecting beyond the very small mouth; body much compressed, broadly fusiform, the back elevated and arched. Dorsal rays 14. Color silvery, with plumbeous shades above; lower fins white. Size small. Catawba and Yadkin Rivers, North Carolina (*Cope.*)

(*Ptychostomus coregonus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 472; Jordan, Man. Vert. 317; Jordan, Bull. U. S. Nat. Mus. xii, 134.)

†† Lower lip thin, forming a narrow, crescent-shaped border around the mandible.

157. M. album (Cope) Jordan.—*White Mullet.*

Head small, 5 times in length. Muzzle prominent, but less so than in *M. coregonus.* Mouth moderate. Back a little elevated. Depth about $3\frac{1}{3}$ in length. Dorsal rays 12–14, its free border often incised. Scales 6–45–5. Coloration very pale; lower fins white. Size large; reaches a weight of 4 pounds or more. Catawba and other rivers of North Carolina.

(*Ptychostomus albus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 472; Jordan, Man. Vert. 316; Jordan, Bull. U. S. Nat. Mus. xii, 130.)

158. M. thalassinum (Cope) Jordan.

Head stout, as in *M. velatum*, rather long, 4 in length, flattish above, muzzle truncate, not very prominent. Mouth moderate. Back elevated. Dorsal fin long, of 14 or 15 rays. Sea-green above, white below; lower fins white. Yadkin River. (*Cope.*)

(*Ptychostomus thalassinus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 472; Jordan, Man. Vert. 316; Jordan, Bull. U. S. Nat. Mus. xii, 131.)

††† Lower lip full, its posterior edge truncate.

d. Dorsal rays 15–18 in number.

159. M. carpio (Val.) Jordan.—*Carp Mullet.*

Dorsal fin largely developed, its rays 15–18 in number. Head rather large, $3\frac{2}{3}$–$4\frac{1}{4}$ in length, broad above. Mouth large, with full lips. Eye rather large. Body deep, strongly compressed, the back somewhat elevated, the depth about $3\frac{1}{4}$ in length. Dorsal fin high and large, larger than in any other species of the genus, the first ray about as long as the base of the fin. Scales 5–43–4, quite large. Coloration very pale and silvery; the lower fins white. Ohio Valley, Great Lakes, and northward.

(*Catostomus carpio* Valenciennes, Hist. Nat. Poiss. xvii, 457, 1844: *Catostomus carpio* Günther, vii, 20; Jordan, Man. Vert. 312; Jordan, Bull. U. S. Nat. Mus. xii, 118.)

dd. Dorsal rays 12–14 in number.

e. Scales large, 41–50 in the course of the lateral line.

f. Caudal fin normal, the two lobes about equal and similarly colored.

160. M. macrolepidotum (Le Sueur) Jordan.—*Common Red Horse; Mullet; White Sucker; Large-scaled Sucker.*

Head comparatively elongate, bluntish, rather broad and flattened above, 4–5 in length. Body stoutish, varying to moderately elongate. Lips rather full, the bluntish muzzle projecting beyond the large mouth; greatest depth of cheeks more than half distance from snout to preopercle. Eye rather large. Dorsal fin medium, its developed rays 12–14, usually 13 in number, its free edge nearly straight, its longest ray shorter than head. Scales large, about 45 in the lateral line. Olivaceous; sides silvery; lower fins in the adult red or orange. Great Lakes to Virginia, southwestward to Arizona; one of the most abundant fishes, reaching a length of 2 feet or more. The Red Horse of the Ohio and Mississippi, with the head relatively longer and the mouth larger, is perhaps worthy of distinction as var. *duquesni* (Le Sueur) Jor. The eastern form (var. *macrolepidotum*) is scarcely distinguishable from the next species.

(*Catostomus macrolepidotus* and *duquesni* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 94, 105, 1817: *Catostomus erythrurus* Raf. Amer. Month. Mag. 1818, 354: *Catostomus duquesni* Günther, vii, 18: *Myxostoma macrolepidota* and vars. *duquesni* and *lachrymalis* Jordan, Man. Vert. 313; Jordan, Bull. U. S. Nat. Mus. xii, 120: *Ptychostomus duquesni, erythrurus, robustus, oneida, lachrymale*, etc. Cope, Proc. Amer. Phil Soc. 1870. *Myxostoma euryops* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 348, is probably a monstrosity of this species.)

161. M. aureolum (Le S.) Jordan.

Head comparatively short, low and small, conic, 5-5½ in length. Back elevated and compressed. Depth 3½ in length. Mouth small, overpassed by the snout, the lips thin and small, the greatest depth of cheek half the distance from snout to preopercle. Eye small. Coloration bright yellowish brown, somewhat silvery; lower fins bright red. Dorsal rays 13, the fin somewhat falcate, its free edge concave, its longest ray longer than head. Scales 5–45–4. Great Lakes, Ohio Valley, and northward.

(*Catostomus aureolus* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 95, 1817: *Catostomus macrolepidotus* Günther, vii, 18; Jordan, Man. Vert. 314; Jordan, Bull. U. S. Nat. Mus. xii, 124: *? Cyprinus lesueuri* Rich, Franklin's Journ. 1823, 772.)

162. M. crassilabre (Cope) Jordan.

Body flattish, the back elevated and compressed. Depth 3¾. Muzzle contracted, lower lip thick. Scales large, 5–44–5. Dorsal rays usually 12. Dorsal fin elevated in front, its first soft ray longer than the base of the fin. Color silvery, with smoky shading above, some of the scales

blackish at their bases; lower fins white; top of head, humeral bar, and dorsal fin dusky. Neuse River, North Carolina. (*Cope.*) Probably identical with the preceding.

(*Ptychostomus crassilabris* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 477; Jordan, Man. Vert. 314; Jordan, Bull. U. S. Nat. Mus. xii, 126.)

163. M. conus (Cope) Jordan.

Body flattish, the dorsal outline elevated, the form being like that of *M. coregonus.* Head small and conic. Mouth exceedingly small, the snout far overpassing it, the muzzle being much longer than in *M. crassilabre.* Dorsal rays 14. Eye large. Coloration smoky above, some scales dusky at their bases; sides pale; lower fins white. Yadkin River, North Carolina. (*Cope.*)

(*Ptychostomus conus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 478; Jordan, Man. Vert. 314; Jordan, Bull. U. S. Nat. Mus. xii, 126.)

ff. Caudal fin with the upper lobe longer than the lower, the two similarly colored.

164. M. anisurum (Raf.) Jordan.

Caudal fin with the upper lobe falcate, much longer than the lower, at least in the adult, the lobes similarly colored. Dorsal fin short and high, falcate. Body compressed. Back somewhat elevated. Depth $3\frac{1}{2}$ in length. Head conic, flattish, $5\frac{1}{4}$ in length. Mouth very small, much as in *aureolum*, from which it can probably be distinguished only by the form of the caudal. D. 12–13, half higher than long. Scales 6–46–5. Ohio Valley and Great Lake region.

(*Catostomus anisurus* Raf. Ichth. Oh. 54: *Ptychostomus breviceps* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 478; Jordan, Man. Vert. 315; Jordan, Bull. U. S. Nat. Mus. xii, 126.)

fff. Caudal fin with the lower lobe distinctly longer than the upper and differently colored, the upper lobe in the adult being red, the inferior jet-black, its two lowermost developed rays and their membranes abruptly pale (?in both sexes).

165. M. pœciurum Jordan.

Body elongate, moderately compressed, somewhat elevated forwards. Depth $4\frac{1}{3}$ in length. Head about the same. Mouth medium, the lips full. Dorsal rays 13. Scales large, 5–44–4. Coloration usual, except of the caudal fin; other fins all red, with blackish shadings. Size small. Louisiana and Southern Mississippi.

(Jordan, Bull. U. S. Nat. Mus. x, 66; Jordan, Man. Vert. 315; Jordan, Bull. U. S. Nat. Mus. xii, 129.)

ee. Scales very small for the genus, about 56 in lateral line; body moderately elongate, the depth about 4 in length.

166. M. albidum (Grd.) Jordan.

Head shortish, conic, the snout not much projecting, about 4 in length; eye large. Dorsal fin small, with about 11 rays, the last rapidly

shortened. (Characters of mouth unknown, but probably similar to *macrolepidotum* and *pœcilurum;* it is said to be "much larger than in *P. congestus*".) Rio Grande region. (*Girard.*)

(*Ptychostomus albidus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 172; Jordan, Man. Vert. 315; Jordan, Bull. U. S. Nat. Mus. xii, 128.)

ddd. Dorsal rays mostly less than 12; body very slender.

167. M. cervinum (Cope) Jordan.—*Jumping Mullet; Jump-rocks.*

Head very short, roundish above, rather pointed forwards, about 5 in length. Cheeks subvertical, their depth less than half the distance from snout to preopercle. Mouth rather large, with thick lips, which are strongly plicate, the folds somewhat broken up. Eye small. Fins very small; the dorsal rays 10–12; free edge of dorsal straight, its longest ray less than head. Scales rather large, 6–44 to 49–5. Color greenish brown; a pale blotch on each scale, these forming continuous streaks along the rows of scales; back with more or less distinct brownish cross-blotches; fins brownish, not much red, the dorsal blackish at tip. Size smallest in the genus. Length less than a foot. Rivers of the South Atlantic States from the James to the Chattahoochee.

(*Teretulus cervinus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 236: *Ptychostomus cervinus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 478; Jordan, Man. Vert. 315; Jordan, Bull. U. S. Nat. Mus. xii, 129.)

69.—PLACOPHARYNX Cope.

Big-jawed Suckers.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 467: type *Placopharynx carinatus* Cope.)

Suckers like *Moxostoma* in all respects, except that the pharyngeal bones are much more developed and the teeth reduced in number, those on the lower half of the bone very large, 6–10 in number, nearly cylindric in form, being but little compressed, and with a broad, rounded or flattened grinding surface. The forms and positions of these enlarged teeth vary greatly. In a specimen before us the first tooth is the highest and most compressed, its summit being rounded and then abruptly truncate. The second tooth is notably shorter and thicker, much larger, and rounded on top, the body of the tooth serving as a peduncle for the swollen grinding surface. The third tooth is still shorter and similar in form. The fourth tooth is similar to the first, being much higher than the second and third, and flat on top. The others seem to be irregularly alternated or arranged in pairs, a long one and a short one, the long teeth in all cases being the most truncated, as if their surfaces had been most worn off. The mouth is larger and more oblique than usual

in *Moxostoma*, and the lips are thicker. Size large. (πλάξ, a broad surface; φάρυγξ, pharynx.)

168. P. carinatus Cope.

Body oblong, moderately compressed, heavy at the shoulders. Head very large, $3\frac{2}{3}$ in length of the body. Eye small, behind the middle of the head. Mouth extremely large, the lower jaw oblique when the mouth is closed, the mouth, therefore, protractile forwards as well as downwards. Lips very thick, coarsely plicate, the lower lip full and heavy, truncate behind. Head above evenly rounded or somewhat carinated. Scales 6–45–6. Dorsal rays 13; ventral 9. Color brassy green above; lower fins red. Great Lakes and Mississippi Valley; abundant in many streams.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 467; Jordan, Man. Vert. 311; Jordan, Bull. U. S. Nat. Mus. xii, 108.)

70.—QUASSILABIA Jordan & Brayton.

Hare-lip Suckers.

(*Lagochila* Jordan & Brayton, preoccupied.)

(Jordan & Brayton, Man. Vert. E. U. S. ed. 2, 1878, 401: type *Lagochila lacera* Jordan & Brayton.)

Suckers like *Moxostoma* in every respect excepting the structure of the mouth. Head shortish, conical, with lengthened snout; its length $4\frac{1}{2}$–5 times in that of the body, the opercular region being reduced, so that the eye is well backwards. Suborbital bones narrow. Fontanelle large, widely open. Mouth large, singular in structure, inferior, the upper lip not protractile, greatly prolonged, closely plicate. Lower lip much reduced, divided into two distinct elongate lobes, which are weakly papillose. The split between these lobes extends backwards to the edge of the dentary bones, which are provided with a rather hard, horny plate, as in *Pantosteus*. The lower lip is entirely separated from the upper at the angles by a deep fissure. The skin of the cheeks forms a sort of cloak over this fissure, the crease separating this skin from the mouth extending up on the sides of the muzzle. The crease between the lips extends down on the under side of the head. System of muciferous tubes well developed. Pharyngeal bones not dissimilar from the usual type in *Moxostoma*, rather weak, with numerous small teeth. Body elongate, not much compressed, not elevated. Fins moderate, formed as in *Moxostoma*. Scales large, as in *Moxostoma*, the lateral line well developed and nearly straight, with about 45 scales in its course. Air-bladder in three parts. Sexual peculiarities unknown; probably little marked. (*Quassus*, broken or torn; *labia*, lip.)

169. Q. lacera Jor. & Brayt.—*Hare-lip Sucker; Cut-lips; Split-mouth Sucker; May Sucker; Rabbit-mouth Sucker.*

Head short, conical, with lengthened snout, the region between the eyes flattened and with prominent mucous ridges. Cheeks and lower part of head rather swollen. Opercle much reduced, its greatest length scarcely greater than the diameter of the eye. Head about $4\frac{2}{3}$ in length. Eye $4\frac{1}{3}$ in length of head, about 2 in length of the snout, its situation thus quite posterior. Length of the top of the head $2\frac{2}{3}$ in the distance from the snout to the base of the dorsal. Body rather slender, the form being between that of *Moxostoma cervinum* and *M. macrolepidotum*, the depth $4\frac{2}{3}$ in the length. Dorsal fin rather low, its rays I, 12; A. I, 7; V. 9. Scales 5–45–5. Color olive or bluish brown above; sides and belly silvery; lower fins faintly orange. Ohio Valley and southward. A singular species, abundant in some sections (Scioto River, Clinch River, Chickamauga River), but overlooked by naturalists until lately.

(*Lagochila lacera* Jordan & Brayton, Proc. Acad. Nat. Sci. Phila. 1877, 280: *Lagochila lacera* Jordan, Man. Vert. ed. 2, 311: Jordan, Man. Vert. ed. 2, 406; Jordan, Bull. U. S. Nat. Mus. xii, 106.)

FAMILY XXXI.—CYPRINIDÆ.

(*The Carps.*)

Cyprinoid fishes with the margin of the upper jaw formed by the premaxillaries alone and the lower pharyngeal bones well developed, falciform, nearly parallel with the gill-arches, each provided with 1–3 series of teeth in small number, 4–7 in the main row, and a less number in the others if more are present. Head naked. Body scaly (except in *Meda*, *Plagopterus*, *Phoxinellus*, and *Aulopyge*). Barbels 2 or 4; absent in most of our genera, and not large in any. Belly usually rounded, rarely compressed, never serrated. Gill-openings moderate, the membranes broadly joined to the isthmus. Brachiostegals always 3. Gills 4, a slit behind the fourth. Pseudobranchiæ present (except in *Orthodon*, etc.). No adipose fin. Dorsal fin short in American species, elongate in many Old World forms. Ventral fins abdominal. Air-bladder usually large, commonly divided into an anterior and posterior lobe, rarely wanting, not enclosed in a bony capsule. Stomach without appendages, appearing as a simple enlargement of the intestines. Fishes of moderate or small size, inhabiting the fresh waters of the Old World and of North America. Genera about 200; species nearly 1,000; excessively abundant where found, both in individuals and species, and, from their great uniformity in size, form, and coloration, constituting one of the most difficult groups in natural history in

which to distinguish genera and species. Our genera are mostly very closely related, and are separated by characters which, although reasonably constant, are often of slight structural importance. From time to time, different authors have proposed to throw most of these groups into the genus *Leuciscus*, a procedure which, without further discussion, may be said to have always led to confusion. The spring or breeding dress of the male fishes is often peculiar. The top of the head, and often the fins or various portions of the body, are covered with small tubercles, outgrowths from the epidermis. The fins and parts of the body in the spring males are often charged with bright pigment, the prevailing color of which is red, although in some genera it is satin-white, yellowish, or black.*

(*Cyprinidæ*, part, Günther, vii, 25–339.)

* Dorsal fin short, without developed spine.

† Air-bladder surrounded by many convolutions of the very long alimentary canal. (*Campostominæ.*)

A. Teeth 4–4, or 1, 4–4, 0, with oblique grinding surface and slight hook; peritoneum black.

CAMPOSTOMA, 71.

†† Air-bladder above the alimentary canal; teeth one-rowed. (*Chondrostominæ.*)

‡ Intestinal canal elongate, more than twice the length of the body; teeth with grinding surface well developed; peritoneum usually black.

B. Jaws each with a conspicuous, broad, straight-edged, horny plate; teeth 4–5, stout, bluntish, hooked, and short.

ACROCHILUS, 72.

BB. Jaws without horny plate.

C. Teeth 6–6, strongly compressed, knife-shaped; pseudobranchiæ none; rudimentary caudal rays greatly developed; scales very small.

ORTHODON, 73.

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* No progress can be made in the study of these fishes without a careful examination of the teeth. The pharyngeal bones in the smaller species can be removed by inserting a pin or a hook through the gill-opening, under the shoulder-girdle. The teeth should be carefully cleaned with a tooth-brush, or a jet of water, or a pin, and may be examined by any small lens. In most cases a principal row of 4 or 5 teeth will be found, in front of which is sometimes a set of 1 or 2 smaller ones. The two sides are not always symmetrical. "Teeth 4–4" indicates a single row of 4 on each pharyngeal bone. "Teeth 2, 4–5, 1" indicates 2 rows of teeth on each side—on the one side 4 in the principal row and 2 in the lesser, on the other side 5 in the main row and 1 in the lesser. In the *Leuciscine* genera these teeth, or the principal ones, are *raptatorial*, that is, hooked inward at their tips. A *grinding* or *masticatory* surface is an excavated space or groove usually at the base of the hook. A flattened or bevelled edge sometimes simulates a masticatory surface, and in some of the species the grinding surface is very narrow and confined to but one or two of the teeth. In all cases where the number of teeth is given in the *specific* descriptions following, this number has been verified on typical examples either by Professor Cope or the writers.

CC. Teeth 5-5 or 4–5; pseudobranchiæ present; dorsal fin inserted posteriorly.

D. Lateral line complete; rudimentary caudal rays numerous; anal basis elongate..LAVINIA, 74.

DD. Lateral line incomplete; anal basis short; scales minute. CHROSOMUS, 75.

CCC. Teeth 4–4; dorsal fin nearly median.

E. First (rudimentary) ray of dorsal slender, firmly attached to the first developed ray.

F. Scales very small, 85–90 in the lateral line, which is complete. ZOPHENDUM, 76.

FF. Scales larger, 35–60 in the lateral line.

G. Lateral line complete.....HYBOGNATHUS, 77.

GG. Lateral line incomplete.....COLISCUS, 78.

EE. First (rudimentary) ray of dorsal somewhat enlarged and blunt, connected by membrane with the first developed ray.

H. Lateral line incomplete .....PIMEPHALES, 79.

HH. Lateral line complete.....HYBORHYNCHUS, 80.

‡‡ Intestinal canal short, less than twice the length of the body; teeth hooked, the grinding surface, if present, narrow or rudimentary; peritoneum usually pale.

§ Dentary bones parallel, united for their whole length. (*Exoglossinæ.*)

I. Premaxillaries not protractile; mandible with a conspicuous fleshy lobe on each side at base. EXOGLOSSUM, 81.

§§ Dentary bones arched, free from each other, except at the symphysis. (*Leuciscinæ.*)

J. Abdomen behind ventral fins not compressed to an edge, the scales passing over it; anal basis generally short.

K. Teeth in the main row 4–4.

L. Maxillary without barbels.

M. Jaws each with a hardened bony sheath; first ray of dorsal spine-like, connected by membrane with the first developed ray; teeth 4–4. COCHLOGNATHUS, 82.

MM. Jaws without bony sheath.

N. Lower jaw with the lip thin or obsolete, not developed as a fleshy lobe on each side at base.

O. Mandible, interopercle, and suborbital not cavernous.

P. Teeth 4–4, or 1, 4–4, 1 (1, 4–4, 2 in one species).

R. Lateral line incomplete.
HEMITREMIA, 83.
RR. Lateral line complete.... CLIOLA, 84.
PP. Teeth 2, 4–4, 2.
S. Lateral line complete.. MINNILUS, 85.
SS. Lateral line incomplete; scales small. PROTOPORUS, 86.
OO. Mandible, interopercle, and suborbital with conspicuous, externally visible, cavernous chambers; teeth 1, 4–4, 0.
ERICYMBA, 87.
NN. Lower jaw with the lip developed as a fleshy lobe on each side; teeth 4–4; dorsal anterior.
PHENACOBIUS, 88.
LL. Maxillary with a small barbel at its extremity.
U. Premaxillaries not protractile; teeth 2, 4–4, 2; scales small; dorsal posterior.
RHINICHTHYS, 89.
UU. Premaxillaries protractile.
V. Teeth 4–4, or 1, 4–4, 1, or 1, 4–4, 0.
W. Scales very small; dorsal posterior.
X. Lateral line complete.
AGOSIA, 90.
XX. Lateral line incomplete.
APOCOPE, 91.
WW. Scales large; dorsal median; lateral line complete.
CERATICHTHYS, 92.
VV. Teeth 2, 4–4, 2.
Y. Head convex above; teeth without grinding surface .. COUESIUS, 93.
YY. Head flattened above; teeth with grinding surface... PLATYGOBIO, 94.
KK. Teeth in the main row 5–5 or 4–5.
Z. Maxillary with a barbel; premaxillaries protractile.
a. Teeth hooked, none of them molar; teeth in the lesser row 2.
b. Caudal fin symmetrical, its rudimentary basal rays not greatly developed.
c. Barbel minute, lateral; teeth without grinding surface..... SEMOTILUS, 95.
cc. Barbel terminal; teeth with grinding surface..... SYMMETRURUS, 96.
bb. Caudal fin unsymmetrical, the upper lobe much the longer, the basal caudal rays greatly developed ..... POGONICHTHYS, 97.
aa. Teeth partly molar, much enlarged, obtusely truncate, lesser row with 2 teeth; scales small..... MYLOCHILUS, 98.
ZZ. Maxillary without barbel.
d. Upper jaw not protractile; 2 or 3 teeth modified, molar; teeth 2, 5–5, 2, or 2, 5–4, 2..... MYLOPHARODON, 99.

dd. Upper jaw protractile; teeth not molar.
e. Teeth two-rowed, 2 teeth in the lesser row.
f. Lateral line complete.
g. Teeth subconical, scarcely hooked, sharp-edged, wide apart, the long limb of the pharyngeal bone elongate.
PTYCHOCHILUS, 100.
gg. Teeth compressed, close-set, strongly hooked; the pharyngeal bone of the usual form.
h. Caudal peduncle slender and elongate, the caudal fin widely forked, its basal rudiments much developed; scales very small; head depressed .....GILA, 101.
hh. Caudal peduncle stout; basal rudiments of caudal little developed.
SQUALIUS, 102.
ff. Lateral line incomplete.....PHOXINUS, 103.
ee. Teeth one-rowed.
– Lateral line complete.
g. Mouth of moderate size.....LEUCOS, 104.
gg. Mouth extremely small .....OPSOPŒODUS, 105.
– – Lateral line incomplete; teeth serrate .....TRYCHÆRODON, 106.
JJ. Abdomen behind ventral fins compressed to an edge, the scales not passing over it; anal basis usually elongate; dorsal posterior.
i. Abdomen in front of ventrals rounded; anal basis rather long.
j. Teeth 5–5, with grinding surface and serrate edges.
NOTEMIGONUS, 107.
jj. Teeth 2, 5–5, 2, entire, without grinding surface. ALBURNUS, 108.
** Dorsal fin short, posterior, with a strong spine, composed of two, the posterior received into a longitudinal groove of the anterior; inner border of the ventral fins adherent to the body; teeth hooked, without grinding surface, in two rows. (*Plagopterinæ.*)
l. Body with small scales; teeth 2, 4–4, 2; no barbels.
LEPIDOMEDA, 109.
ll. Body scaleless.
m. Maxillary without barbel; teeth 1, 4–4, 1.....MEDA, 110.
mm. Maxillary with a barbel; teeth 2, 5–4, 2.
PLAGOPTERUS, 111.
*** Dorsal fin elongate; dorsal and anal fins each preceded by a serrated spine; scales large; teeth molar; species introduced. (*Cyprininæ.*)
n. Barbels 4; teeth 1, 1, 3–3, 1, 1 .....CYPRINUS.
nn. Barbels none; teeth 4–4 .....CARASSIUS.

71.—CAMPOSTOMA Agassiz.

Stone rollers.

(Agassiz, Amer. Journ. Sci. Arts, 1855, 218: type *Rutilus anomalus* Raf.)

Body moderately elongate, little compressed. Mouth normal, the jaws with thick lips and rudiment of a hard sheath. Premaxillaries protractile; no barbel. Teeth 4–4, or 1, 4–4, 0, with oblique grinding surface and but a slight hook on one or two teeth. Air-bladder sus-

pended in the abdominal cavity, and entirely surrounded by many convolutions of the long alimentary canal, which is 6–9 times the total length of the body. Ovaries similarly enclosed in the alimentary canal. Peritoneum black. Pseudobranchiæ present. Scales moderate. Lateral line present. Dorsal nearly over ventral. Anal basis short. No spines. Herbivorous. Sexual differences very great, the males being covered with large tubercles in spring. The singular arrangement of the intestines in relation to the air-bladder is peculiar to *Campostoma* among all known fishes. Size moderate. (*καμπή*, curve; *στόμα*, mouth.)

* Scales small, 75–80 in the lateral line; teeth 4–4 (?).

170. C. ornatum Grd.

Body stout. Head large, blunt and heavy. Mouth large, the maxillary reaching to near the front of the large eye. Tail rather short. Coloration brilliant, precisely as in *C. anomalum*. Head $3\frac{3}{4}$; depth 4. D. 8; A. 8; Lat. l. 78. Chihuahua River. (*Girard.*)

(Grd. Proc. Acad. Nat. Sci. Phila. 1856, 176; Günther, vii, 183.)

** Scales moderate, 48–57.

† Teeth 4–4.

171. C. anomalum (Raf.) Ag.—*Stone-roller; Stone-lugger.*

Body stoutish, moderately compressed, the ante-dorsal region becoming swollen and prominent in the adult. Snout moderately decurved. Scales deep, rather small and crowded anteriorly. Maxillary not reaching to opposite the front of the eye. Color brownish, with a brassy lustre above, the scales more or less mottled with dark. A dusky vertical bar behind the opercle. Dorsal and anal fins each with a dusky cross-bar about half way up, the rest of the fin olivaceous in females, fiery red in the males in the spring. Iris orange in males. Males in the spring with the head and often the whole body covered with large, rounded tubercles. In no other Cyprinoid are these nuptial appendages so extensively developed. Head $4\frac{1}{5}$; depth $4\frac{2}{5}$. D. 8; A. 7; scales 7–53–8; teeth 4–4. L. 6–8 inches. Extremely variable, the young very different in appearance from the old males. Western New York to Mexico, everywhere abundant in deep or still places in small streams, running up small brooks to spawn in spring. Herbivorous. One of the most interesting and curious of our fishes.

(*Rutilus anomalus* Raf. Ichth. Oh. 52: *Exoglossum dubium* Kirtland, Bost. Journ. Nat. Hist. v, 272: *Exoglossum spinicephalum* Cuv. & Val. xvii, 489: *Chondrostoma pullum* Agassiz, Amer. Journ. Sci. Arts, 1854, 357: *Campostoma callipteryx, mormyrus, gobioninum,* and *hippops* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 284: *Campostoma nasutum*

Grd. Proc. Acad. Nat. Sci. Phila. 1856, 176, from the Rio Grande, may be a distinct species (specimens before us have a slenderer head and rather more compressed and elevated body than is usual in *C. anomalum*): *Campostoma dubium* Günther, vii, 183; Agassiz, Amer. Journ. Sci. Arts, 1855, 218; Jordan, Man. Vert. ed. 2, 287.)

†† Teeth 1, 4–4, 0.

172. C. prolixum (Storer) Jordan & Gilbert.

Slenderer than *C. anomalum*. Head rather shorter and narrower. Scales larger and less crowded, and the coloration more uniform and paler, or more silvery. Head $4\frac{3}{5}$; depth $4\frac{1}{2}$. D. 8; A. 7; scales 7–49–6; teeth 1, 4–4, 0. Tennessee, Georgia, and Alabama; abundant. Very similar to the preceding, but probably worthy of specific distinction on account of the difference in dentition, constant in all specimens examined.

(*Leuciscus prolixus* Storer, Proc. Bost. Soc. Nat. Hist. July, 1845: *Campostoma anomalum* var. *prolixum* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 326.)

*** Scales larger, about 45 in the course of the lateral line; teeth 4–4 (?).

173. C. formosulum Grd.

Head short and blunt, with broad, projecting snout. Head 4; depth $4\frac{1}{2}$. D. 8; A. 7; Lat. l. 45. Grayish above, whitish below; sides more or less marmorate; a black patch at the base of the caudal and on the dorsal. San Antonio River, Texas. (*Girard.*)

(Grd. Proc. Acad. Nat. Sci. Phila. 1856, 176.)

72.—ACROCHILUS Agassiz.

Hard-mouths.

(*Acrocheilus* Agassiz, Amer. Journ. Sci. Arts, 1855, 211: type *Acrocheilus alutaceus* Agassiz & Pickering.)

Body elongate, little compressed. Both jaws with a large, straight, horny plate, sharp externally and very conspicuous. Upper jaw protractile. No barbel. Teeth 4–5, stout, hooked, with broad masticatory surface. Intestinal canal elongate. Peritoneum black. Pseudobranchiæ present. Scales small, loosely imbricated. Lateral line present. Dorsal fin slightly behind ventrals. Anal basis moderate. Caudal fin broad, its rudimentary rays recurrent on the caudal peduncle. Size rather large. (ἄκρος, sharp; χεῖλος, lip.)

174. A. alutaceus Agass. & Pick.—*Hard-mouth.*

General form and appearance of the species of *Gila*, but the head not depressed, and more blunt forward. Body elongate, not much compressed, its sides more so than the caudal peduncle; the greatest depth, over the ventrals, 4 in length. Caudal peduncle very long and slender,

nearly terete, its length contained $4\frac{2}{3}$ times in the length of the body, its least depth $2\frac{2}{3}$ in its length. Head moderate, $4\frac{1}{4}$ in length of body, bluntish, the profile considerably rounded, the interorbital space strongly convex. Mouth horizontal, subinferior, overlapped by the broad, blunt snout, its breadth considerable, but the maxillary not extending far back, to opposite the front of the eye. Upper jaw protractile, covered with a fleshy lip, inside of which is a small, straight, cartilaginous plate, similar to that on the lower jaw, but much smaller and not evident externally. Lower lip covered with a firm cartilaginous plate, sharp externally, the upper surface being formed by its bevelled edge. The transverse width of this plate is between four and five times its (longitudinal) breadth. The plate extends in nearly a straight line from one angle of the mouth to the other; its transverse width is contained $2\frac{3}{4}$ times in the length of the head. Eye rather large, $5\frac{1}{2}$ in head, $1\frac{3}{4}$ in snout, its position anterior and not high up, $2\frac{1}{4}$ in interorbital space. Dorsal long, rather low, its first ray just behind the first ray of ventrals, midway between the snout and the middle of the base of the caudal fin. Caudal fin very long, the lobes about equal, longer than the head, widely forked, the accessory rays at is base very numerous and recurrent on the caudal peduncle; about eight of these may be distinguished on each side of the fin. Anal fin rather large; ventrals broad, reaching vent. Pectorals moderate, not reaching two-thirds of the distance to the ventrals. Scales quite small, somewhat imbedded in the skin, very loosely imbricated, or often scarcely imbricated at all, the exposed surfaces longer than high, profusely punctate; squamation quite irregular; the scales smaller on back and belly than on sides, most exposed on caudal peduncle. Lateral line much decurved. Coloration very dark, belly paler, but nearly all parts of the body studded with minute dark points. D. 10; A. 9; scales 20–85–16. Teeth 4–5, hooked, somewhat club-shaped, with a broad masticatory surface. Peritoneum black; intestines much elongate, filled in this specimen with vegetable substance. L. 12 inches. Columbia River and tributaries.

(Agassiz, Amer. Journ. Sci. Arts, xix, 214, 1855; Günther, vii, 276; Jordan, Proc. U. S. Nat. Mus. i, 83, 1878.)

73.—ORTHODON Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 182: type *Gila microlepidota* Ayres.)

Body elongate. Jaws normal, the upper protractile, the lower sharp-edged, with a knob at the symphysis; no barbel. Teeth 6–6 or 6–5,

much compressed, lancet-shaped, erect, nearly straight. Upper limb of the pharyngeal bone very broad and concave, separated by a deep notch from the dentigerous portion, the bone thin and brittle. Intestinal canal elongate, about 7 times the length of the fish; peritoneum black. Scales small. Lateral line present. Dorsal fin opposite ventrals. Basal rays of caudal largely developed. Anal basis short. Pseudobranchiæ none. Gill-rakers moderate, clavate, the inner edge fringed. Size large. This genus is related to *Chondrostoma*, differing chiefly in the absence of pseudobranchiæ and of the horny mandibular plate. (*ὀρθός*, straight; *ὀδών*, tooth.)

175. O. microlepidotus (Ayres) Grd.

Body elongate. Head moderate; the snout very broad; eye small, about half the length of the snout. Mouth terminal, somewhat oblique, broad, the maxillary not extending to the eye. Upper head of surface flattish, with two bony ridges. Fins rather large; the caudal strong. Coloration plain. Lateral line decurved. Head 4; depth 4½. D. 9; A. 8; scales 21–105–12; Vert. 24 + 20. Teeth 6–6 or 6–5, formed much as in *Campostoma*, but longer. Size large. L. 12 inches. Rivers of California; Great Basin of Utah (*Yarrow*).

(*Gila microlepidota* Ayres, Proc. Cal. Acad. Nat. Sci. i, 21, 1855; Girard, U. S. Pac. R. R. Surv. Fish. 237, fig.; Günther, vii, 275.)

74.—LAVINIA Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 137: type *Lavinia exilicauda* B. & G.)

Body elliptical, elevated, moderately compressed, rapidly contracted to the slender caudal peduncle. Head small, conical. Mouth moderate, terminal, oblique; the lower jaw included. Scales moderate, not closely imbricated, the exposed surfaces somewhat hexagonal. Lateral line decurved, complete. Belly behind ventrals entirely scaled. Dorsal fin well behind ventrals, its last ray just in front of the beginning of the anal, which is rather elongate. Caudal fin little forked, its rudimentary basal rays much increased in number and very strong. Intestinal canal elongate, 3 times the total length of the fish; peritoneum dark. Teeth 4–5 or 5–5, scarcely hooked, cultriform, with rather broad but shallow grinding surface, the largest standing up well above the surface of the bone. Gill-rakers rather long and slender; pseudobranchiæ large. Size large. (*Lavinia*, a classical name, without special application to these fishes.)

176. L. exilicauda B. & G.

Body deep, compressed, tapering to the caudal peduncle, which is very slender. Head small, short, conical. Mouth rather small, oblique, the upper lip on the level of the lower part of the pupil, the maxillary falling short of the eye. Preorbital short and deep; suborbital moderate. Eye rather large, anterior, 4 in head. Scales rather large, 42 in front of dorsal. Dorsal fin rather small. Pectorals short. Anal high and long. Caudal well forked, its rudimental rays strong, about 10 in number. Color dark above, sides somewhat silvery. Scales with dark specks. Head $4\frac{2}{3}$; depth $3\frac{1}{3}$. D. 10; A. 12; scales 13–64–8; teeth 4–5 or 5–5. L. 12 inches. Rivers of California.

(Baird & Girard. Proc. Acad. Nat. Sci. Phila. 1854, 137; Girard, U. S. Pac. R. R. Surv. x, 241: *Leuciscus exilicauda* Günther, vii, 248: *Lavinia harengus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 184; the same species.)

75.—CHROSOMUS Rafinesque, 1820.

Red Minnows.

(Rafinesque, Ichth. Oh. 47: type *Luxilus erythrogaster* Raf.)

Body moderately elongate, little compressed. Jaws normal; no barbel. Teeth 5–5 or 4–5, moderately hooked, with well-marked grinding surface. Alimentary canal elongate, about twice as long as body; peritoneum black. Scales very small. Lateral line short or wanting. Dorsal behind ventrals; anal basis short. Size small. Colors in spring brilliant. (χρός, color; σῶμα, body.)

* Sides of the body with two black stripes; the upper running from the upper angle of the opercle straight to the caudal, sometimes breaking up in spots behind; the lower broader, extending from the snout through the eye, curved downward along the belly, and extending to the caudal, where it ends in a black spot (these stripes faint in the female).

177. C. erythrogaster Agassiz.—*Red-bellied Dace.*

Body oblong, tapering each way from the middle, little compressed. Head moderate, rather pointed. Mouth moderate, terminal, oblique, the jaws about equal. Fins rather small; the dorsal and anal high and short; caudal long. Scales quite small, firmly attached, but not much imbricated. Lateral line developed less than half the length of the body. Color brownish olive, with a dusky dorsal line and often some blackish spots; two black lateral bands as above described; between these a bright, silvery area. Belly below the lower band abruptly silvery. Females obscurely marked. Males in spring with the belly and the interspace between the lateral bands bright scarlet; bases of the vertical fins also scarlet. In high coloration the body is everywhere

minutely tuberculate and the fins are bright yellow. Head 4; depth 4. D. 7; A. 8; scales 16–85–10; teeth usually 5–5. L. 2–3 inches. Pennsylvania to Dakota and Tennessee; abundant in small streams; one of the most beautiful of our fishes.

(*Luxilus* or *Chrosomus erythrogaster* Raf. Ichth. Oh. 1820, 47: *Luxilus erythrogaster* Kirt. Bost. Journ. Nat. Hist. iv, 23, fig. 1844; Cope, Cypr. Penn. 391: *Leuciscus erythrogaster* Günther, vii, 247; Jordan, 302.)

** Sides of body with the upper band beginning opposite the vent and extending backward to the middle of the caudal, terminating in a black spot; lower band extending from snout through eye, downward and backward, ceasing at base of anal; back with dark spots and cross-bars.

178. C. oreas Cope.

Form of the preceding, the snout rather more obtuse. Coloration similar to that of the preceding, except for the difference in pattern. The back clear olive-green, with dark cross-bars; belly, interspace between the lateral bands, and bases of vertical fins bright crimson; fins otherwise yellow. Head 4; depth 4¼. D. 8; A. 8; Lat. l. 67; teeth 5–5. L. 2½ inches. Tennessee and Roanoke Rivers; even more brilliant than the preceding.

(Cope, Journ. Acad. Nat. Sci. Phila. 1868, 233.)

*** Body with two black lateral bands on the side, which unite on the caudal peduncle, the lower broader, decurved, the upper narrow and straight.

179. C. eos Cope.

Slenderer than the preceding; the lateral line less distinct, often entirely wanting. Variations in color as in the other species. Head 4; depth 5. D. 8; A. 8; Lat. l. 77; teeth 5–5. L. 2½ inches. Susquehanna River. Perhaps a variety of *C. erythrogaster*.

(Cope, Proc. Acad. Nat. Sci. Phila. 1861, 523; Cope, Cypr. Penn. 391.)

76.—ZOPHIENDUM Jordan.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 786, 1878: type *Hyborhynchus siderius* Cope.)

This genus is very closely related to *Hybognathus*, differing only in the small size of the scales, there being 55–90 in the course of the lateral line. The physiognomy is somewhat different, and the dorsal fin is inserted more posteriorly than usual in *Hybognathus*. As in *Hybognathus*, the teeth are 4–4, scarcely hooked, with narrow grinding surface, and the intestinal canal is elongate, the peritoneum black. Rocky Mountain region; one species in Western Mexico.* (ζόφος, darkness; ἔνδον, within; in allusion to the black peritoneum.)

* Scales very small, 85–90 in the course of the lateral line.

**Z. australe* Jordan. Body rather elongate, formed much as in *Campostoma anomalum*, somewhat compressed, the back somewhat elevated and rounded anteriorly. Head rather large, slightly depressed above. Mouth moderate, low; the lower jaw

180. Z. siderium (Cope) Jor.

Physiognomy of *Apocope*. Body fusiform. Head rather small, acuminate. Mouth terminal, the upper jaw the longer, maxillary reaching line of orbit. Mouth forming more than a semicircle. Lower jaw hard, less attenuate than is usual in *Hybognathus*. Eye small, $4\frac{1}{10}$ in head. Fins long, the ventrals reaching anal. Color dark iron-gray above, a darker band of the same along the sides, above the lateral line, extending from the end of the snout to the middle of the caudal. Head 4; depth 4. D. 8; A. 7; Lat. l. 88; teeth 4–4. Arizona. (*Cope.*)

(*Hyborhynchus siderius* (*lapsus* for *Hybognathus*) Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 670, 1876.)

** Scales moderate, 55–60 in the course of the lateral line.

181. Z. plumbeum (Grd.) Jor. & Gilb.

Body rather slender. Head moderate, rounded in front. Color uniform, sometimes a black spot at the base of the caudal. D. 8; A. 7; Lat. l. 58; teeth 4–4. Arkansas and Indian Territory. (*Girard.*) This species may, perhaps, be referable to *Hybognathus*.

(*Dionda plumbea* and *spadicea* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 178: *Hyborhynchus puniceus*, Grd. l. c. 179: *Dionda grisea*, Grd. U. S. Pac. R. R. Surv. x, 230.)

77.—HYBOGNATHUS Agassiz.

(*Algoma* and *Dionda* Girard.)

(Agassiz, Amer. Journ. Sci. Arts, 1855, 223: type *Hybognathus nuchalis* Ag.)

Body elongate, somewhat compressed. Mouth horizontal. The jaws normal, sharp-edged; lower jaw with a slight, hard protuberance in front; no barbel; upper jaw protractile. Teeth 4–4, cultriform, with oblique grinding surface and scarcely any hook. Alimentary canal elongate, about 4 times the length of the body. Peritoneum black. Scales large. Lateral line continuous. Dorsal over ventrals. Anal basis short. Size moderate. Species numerous; mostly southwestern, and little known. (ὑβός, gibbous; γνάθος, jaw.)

* Body comparatively elongate, little compressed, the depth less than two-sevenths of the length.

a. Suborbital bones comparatively long and narrow.

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slightly included; the premaxillary below the level of the eye; the maxillary just reaching the front of the eye. Lower jaw thin-edged, with a slight symphyseal knob. Eye small, 6 in head. Scales small. Lateral line complete, decurved. Dorsal slightly behind ventrals. Dusky bluish above; everywhere with dark points. A black spot at base of caudal. Head 4; depth 4–18. D. 8; A. 7; scales 10–56–8; teeth 4–4. L. 7 inches. Lake Tupataro, Guanajuato, Mexico (west of the Sierra Madre).

(Jordan, Proc. U. S. Nat. Mus. 1879, 209.)

182. H. nuchalis Ag.—*Silvery Minnow.*

Body elongate, comparatively slender. Head moderate, rather short, the profile evenly curved. Eye large, rather longer than muzzle, about 4 in head. Upper jaw heavy; lower jaw thin. Scales large and silvery. Lateral line decurved, 12–14 large scales in front of dorsal. Olivaceous green above, translucent in life; sides clear silvery, with bright reflections. Fins unspotted. Head 4; depth $4\frac{1}{8}$. D. 8; A. 7; teeth 4–4; scales 5–38–4. L. 5–7 inches. A graceful minnow, abundant in most streams from New Jersey to the Upper Missouri and southward. As here defined, more than one species may be included; but, if so, the authors are unable to distinguish them.)

(Agassiz, Amer. Journ. Sci. Arts, 1855, 224; Günther, vii, 184: *Hybognathus argyritis, evansi*, and *regius* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 182, 209: *Hybognathus regius* Günther, vii, 185: *Hybognathus osmerinus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 466: *Hybognathus argyritis* Jordan, 289.)

183. H. amarus (Grd.) Jordan.

Head very short, small and blunt; front convex rather than declivous, as in *H. nuchalis*. Suborbital bones rather narrow, about as in *H. nuchalis*. Scales moderate, 16 in front of the dorsal. Coloration of *H. nuchalis*, but size much smaller. D. 8; A. 7; Lat. l. 35–38; teeth 4–4. Rio Grande region.

(*Algoma amara* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 180.)

184. H. flavipinnis Cope.

"This fish differs from *H. argyritis* (*nuchalis* of the present memoir) in the smaller scales and quite different coloration. Eye large, horizontally oval, its length $2\frac{2}{3}$ in head, and equal to interorbital width. The muzzle is shortly decurved to the mouth, which is terminal and short. The extremity of the maxillary extends half way from the end of the muzzle to the line of the orbit. Origin of ventral fins below or a little in advance of the base of the first dorsal ray. The pectoral is short, not nearly reaching the ventral, which in turn falls far short of the vent. The lateral line rises anteriorly. The occipital region is convex and rather wide, the interorbital region nearly flat. Color dusky above, a wide dusky lateral band, separated by a pale band from the back. A faint dark spot at base of caudal. Fins pale yellow, unspotted. Head $5\frac{3}{7}$ in length, with caudal fin; depth a little more. D. 8; A. 7 or 8; scales 7–41–4. L. $2\frac{3}{4}$ inches. Llano River, Texas." (*Cope*, MSS.)

185. H. nigrotæniatus Cope.

Similar to *H. flavipinnis*, but with larger scales. Ventral fin originating a little in advance of the first dorsal ray. Eye large, a little

less than one-third the length of the head and a little less than the interorbital width. Ventral fin nearly reaching vent. Color dusky, with a black lateral band. Fins plain. Head 5 in length, with caudal; depth the same. D. 8; A. 8; scales 5–34–3. L. 2½ inches. Medina River, Texas. (*Cope*, MSS.)

aa. Suborbital bones short and deep.

186. H. placitus Grd.

Head short and bluntish. Body stoutish. Eye small, shorter than snout, about 5 in head. Scales moderate, about 16 in front of the dorsal. Size comparatively small. Grayish above, silvery below. Head 4¾; depth 4½. D. 8; A. 7; Lat. l. 40; teeth 4–4. Mississippi Valley to Utah. (Possibly two species are here included.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 182: *Hybognathus nuchalis* Cope, Proc. Amer. Phil. Soc. Phila. 1874, 66: *Hybognathus nuchalis* Jordan, 289; probably not of Agassiz.)

aaa. Suborbital bones unknown; small species of the Texan region.

187. H. episcopus (Grd.) Jordan.

Slender and graceful, fusiform in profile, and compressed, with the back slightly arched. The head is large, forming about the fifth of the length. Eye large and subcircular, the diameter 3½ in head. Fins moderate. Scales large, the lateral line following the middle of the flanks. Dusky above, a blackish band along the sides, ending in a dusty blotch at base of caudal. Fins unmarked. Scales with fine black dots. D. 8; A. 8; Lat. l. 39. L. 3 inches. Rivers of Texas. (*Girard.*) This or some very similar species occurs in Southern Illinois. (*Forbes.*)

(*Dionda episcopa, serena, texensis, papalis, argentosa,* and *chrysitis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 177–178.)

188. H. fluviatilis (Grd.) Jor.

Form, size, and coloration of *H. amarus*, but the mouth and eye smaller and the scales smaller. D. 8; A. 7; Lat. l. 40; 16 scales before dorsal. Snout tuberculate in spring males. New Leon. (*Girard.*)

(*Algoma fluviatilis* Grd. Proc Acad. Nat Sci. Phila. 1856, 181.)

** Body short, deep, compressed, the depth about two-sevenths of the length.

189. H. melanops (Grd.) Jor.

Head moderate, 4¼ in length. Snout rounded. Eye medium. Blackish above; sides smoky, with black dots; a black spot at base of caudal. Depth 3½. D. 8; A. 7; Lat. l. 43; teeth 4–4. L. 2½ inches. Rio Grande region. (*Girard.*)

(*Dionda melanops* and *couchi* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 178; Jordan, Bull. U. S. Geol. Surv. iv, No. 2, 402.)

78.—COLISCUS Cope.

(Cope, Hayden's Geol. Surv. Wyom. 1872, 437: type *Coliscus parietalis* Cope.)

This genus differs chiefly from *Hybognathus* in having the lateral line incomplete or obsolete. The mouth is oblique, and the dorsal fin in advance of the ventrals. (*κόλος*, deficiency; in allusion to the incomplete lateral line.)

190. C. parietalis Cope.

Body moderately elongate. Head wide, especially behind. Muzzle obtuse. Lips equal. Mouth descending obliquely, the maxillary not quite reaching the orbit. Eye $3\frac{2}{3}$ in head. Scales small, the tubes of the lateral line present on 7 of them; 14 in a transverse series. Dorsal fin midway between snout and caudal. Suborbital bones slender. Coloration silvery, unspotted. D. 7; A. 8; Lat. l. 42; teeth 4–4. L. 2–3 inches. Missouri River at Saint Joseph. (*Cope.*)

(Cope, Geol. Surv. Terr. Wyom. for 1870, 1872, 437; Jordan, 289.)

79.—PIMEPHALES Rafinesque.

Fat-heads.

(Rafinesque, Ichth. Oh. 1820, 52: type *Pimephales promelas* Raf.)

Body short and stout, little compressed. Head short and rounded. Mouth small, inferior; upper jaw protractile; no barbel. Teeth 4–4, with oblique grinding surface, usually but one of the teeth hooked. Dorsal over ventrals, its first (rudimentary) ray separated from the rest by membrane. Anal basis short. Intestinal canal elongate. Peritoneum black. Pseudobranchiæ present. Scales rather small. Lateral line incomplete. Size small. (*πιμελῆς*, fat; *κεφαλή*, head.)

191. P. promelas Raf.—*Fat-head; Black-head Minnow.*

Body very short and deep. Head short, everywhere convex, almost globular in adult males. Mouth small, inferior, horizontal. Scales deep, closely imbricated. Lateral line almost wanting, on 5–20 scales only. Olivaceous, the dorsal with a large black bar across it, nearly half way up, most distinct anteriorly, appearing as a simple dusky shade in the young. Male fish dusky, the head jet-black, with several large tubercles on the snout in spring. A dusky shade along sides of caudal peduncle. Head 4; depth 4. D. I, 7; A. 7; scales 7–47–6; teeth 4–4. L. $2\frac{1}{2}$ inches. Ohio Valley to the Upper Missouri; generally abundant in sluggish brooks. Varies greatly with age, sex, and season.

(Raf. Ichth. Oh. 53: *Pimephales fasciatus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 180: *Plargyrus melanocephalus* Abbott, Proc. Acad. Nat. Sci. Phila. 1860, 325: *Pimephales*

milesi Cope, Proc. Acad. Nat. Sci. Phila. 1864, 282 (from Michigan, may be a distinct species; the scales said to be Lat. l. 40, only three series between the lateral line and the ventrals; 5–7 usually in *P. promelas*): *Pimephales agassizii* Cope, Cypr. Penn. 394; Günther, vii, 181: *Pimephales milesii* Günther, vii, 181; Jordan, 288.)

80.—HYBORHYNCHUS Agassiz.

(Agassiz, Amer. Journ. Sci. Arts, 1855, 222: type *Minnilus notatus* Raf.)

This genus differs from *Pimephales* only in having the lateral line complete. The maxillary is often provided with a rudimentary or obsolete barbel. (*ὑβός*, gibbous; *ῥύγχος*, snout.)

*Angle of mouth without trace of barbel.

192. H. confertus Grd.

Aspect of *Pimephales promelas*. Body stout, the back moderately convex. Head wide, formed as in the preceding species. Mouth terminal, very small, oblique. Eye 4 in head. Fins small. Lateral line usually wanting on some of the scales along the sides. Color essentially as in *Pimephales promelas*, the males even darker; the head black; a broad black band across the dorsal; borders of anal and border of ventrals and pectorals black; the lower fins said to be edged with white in life; body somewhat mottled. Females more elongate, plainly colored. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. D. I, 8; A. 7; Lat. l. 43; teeth 4–4. L. $2\frac{1}{2}$ inches. Arkansas River to the Rio Grande; abundant. This species is intermediate between *Hyborhynchus* and *Pimephales*.

(*Hyborhynchus confertus* (♀) and *Pimephales maculosus* (♂) Grd. Proc. Acad. Nat. Sci. 1856, 180: *Hyborhynchus nigellus* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 671.)

193. H. notatus* (Raf.) Ag.—*Blunt-nosed Minnow.*

Body rather elongate, not elevated, moderately compressed. Head moderate; the muzzle blunt and convex; top of the head depressed. Cheeks vertical. Mouth small, inferior, horizontal. Fins small; the dorsal moderate, the first ray distinct and spine-like in the male, slender in the female. Anal small. Caudal fin short. Scales moderate, deep, closely inbricated. Scales in front of dorsal small and crowded. Eye moderate. Color olivaceous, little silvery; sides bluish; a black spot on the dorsal fin in front, near the base; a dusky shade at base of caudal; males in spring with the black on the dorsal more extended and the head wholly black; snout with about 14 disproportionately large tubercles. Head $4\frac{1}{2}$; depth 5. D. I, 8; A. 7; scales 6–45–4; teeth 4–4. L. 4 inches. New York to Arkansas; generally abundant.

(*Minnilus notatus* Raf. Ichth. Oh. 47; Günther, vii, 182; Jordan, 288: *Catostomus*

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* Specimens agreeing closely with this species, but having the intestines no longer than the body (as in *Cochlognathus*), have been lately sent us from Illinois River by Professor Forbes.

melanotus Raf. Ichth. Oh. 58: *Hyborhynchus perspicuus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 185: *Hybognathus perspicuus* Günther, vii, 185.)

**Angle of mouth with a minute, thickish barbel.

194. H. superciliosus Cope.

Head broader, more ridged above. Caudal and anal fins more dusky; otherwise like the last, from which it may be distinguished only by the presence of the small barbel. With the last, equally widely distributed, and even more abundant. Probably a variety.

(Cope, Journ. Acad. Nat. Sci. Phila. 1868, 234; Jordan, 289.)

81.—EXOGLOSSUM Rafinesque.

Cut-lips.

(Rafinesque, Journ. Acad. Nat. Sci. Phila. i, 420, 1818: type *Exoglossum lesueurianum* Raf.=*Cyprinus maxillingua* Le S.)

Body moderately elongate, little compressed. Mouth peculiar, the mandible being contracted and incurved, its outline strongly three-lobed. This appearance is due to the fact that the dentary bones lie close together, parallel, and are united throughout their length, instead of forming a broad arch, as in all other Cyprinoid fishes. The lower lip is represented by a broad fleshy lobe on each side of the mandible. Upper jaw not protractile. Upper lip thick, somewhat plicate. Pharyngeal bones small. The teeth hooked, without grinding surface, 1, 4–4, 1. Scales moderate. Lateral line complete. Fins without spines. Dorsal slightly behind ventrals. Anal rays 7–8. Isthmus broad. Gill-rakers weak. Pseudobranchiæ present. Air-bladder normal. Alimentary canal short; peritoneum white. Size moderate. One of the most strongly marked genera of *Cyprinidæ*, with a single species. (ἔξω, outside; γλῶσσα, tongue.)

195. E. maxillingua (Le Sueur) Haldeman.—*Cut-lips; Stone-toter.*

Body rather stout, little compressed. Head large, broad and flattish above, with tumid cheeks. Mouth moderate, slightly oblique, the end of the maxillary not reaching the line of the orbit. Upper jaw longer than lower. Scales rather crowded anteriorly, those in front of the dorsal small. Color olivaceous; smoky or dark above; a blackish bar behind opercle, and a dusky shade at the root of the caudal in the young; fins unmarked. Head 4; depth 4½. D. 8; A. 7; scales 8–53–5; teeth 1, 4–4, 1. L. 6 inches. Western New York to Virginia; abundant in the Susquehanna Basin, but not widely distributed. One of the most singular of the *Cyprinidæ*, distinguished at sight by its three-lobed lower jaw.

(*Cyprinus maxillingua* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 85; Günther, vii, 188; Jordan, 308; Cope, Cypr. Penn. 1866, 360.)

82.—COCHLOGNATHUS Baird & Girard.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 158: type *Cochlognathus ornatus* B. & G.)

This genus has the general character and appearance of *Hyborhynchus*, the dentition and the structure of the fins being the same; the teeth, however, rather more strongly hooked and with deeper grinding surface. It differs in the structure of the jaws, which are provided each with a hard cutting plate, to all appearance precisely like the *Diodontidæ*, the sharp bony edge being surrounded by the usual lip. First ray of dorsal separated by membrane, and spine-like, as in *Hyborhynchus* and *Pimephales*. Alimentary canal short. Peritoneum white. Pseudobranchiæ present. Lateral line complete. Anal fin small. (κόχλος, shell; γνάθος, jaw; the covering of the jaws being hard, like shell.)

196. C. ornatus Baird & Girard.—*Hard-mouth Minnow.*

Appearance, dorsal fin and coloration essentially as in *Hyborhynchus notatus*. Body moderately elongate. Head rather long. Scales comparatively large. Dorsal fin over the ventrals, rather high. Anal fin quite small. Caudal fin short. Dorsal fin with a black spot near the base in front and a dusky blotch behind. The dorsal spine conspicuous. Caudal fin with a dusky median band, in front and behind which is a pale area. A dusky lateral band. Snout tuberculate in spring males, as in *Hyborhynchus*. Head 4; depth $4\frac{1}{4}$. D. 8; A. 6; Lat. l. 40; teeth 4–4. L. 3 inches. Rio Grande. A singular little fish, with the mouth resembling that of *Chondrostoma* or *Acrochilus*, but the structure otherwise resembling neither.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 158; Günther, vii, 187.)

197. C. biguttatus Cope.

"A fish of rather uniform diameter and deep caudal peduncle. The head is oblong and rather wide above. The muzzle has a decurved profile and terminal mouth. The orbit is large, $3\frac{2}{5}$ in head, a little less than muzzle and than interorbital space. Head wide behind and flat above. The infraorbital bones are narrow, while the preorbital is large, with convex inferior and concave superior border. Maxillary not quite reaching line of orbit. Ventral fins inserted opposite second or third dorsal ray, reaching to vent. Anal fin small. Pectorals reaching three-fifths to ventrals. Color silvery, without dark markings, except a black spot at the base of the caudal and on the anterior rays of the dorsal. Head 5 in length, with the caudal fin; depth a little less. D. 8; A. 7; scales 7–34–? L. $2\frac{1}{2}$ inches. Trinity River, Texas." (*Cope*, MSS.)

83.—HEMITREMIA Cope.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 462: type *Hemitremia vittata* Cope.)

Body moderately elongate. Mouth normal. No barbel. Teeth 4–4 (4–5 or 5–5), hooked, with grinding surface. Scales large. Lateral line incomplete. Dorsal fin slightly behind the ventrals. Anal basis short. Species of small size. The typical species, of which but a single specimen is known, has the teeth 4–5; the normal number is probably 4–4, however, as in the other species. If, however, the teeth in *H. vittata* are permanently 5–4, the remaining species may stand under the generic name of *Chriope*.* (ἡμί, half; τρῆμα, pore.)

* Teeth 4-5? (*Hemitremia.*)

198. H. vittata Cope.

Body stout. Head very short, the muzzle obtuse. Mouth small, oblique, the maxillary not reaching the orbit. Eye large, $3\frac{1}{2}$ in head, equal to length of muzzle. Dosal fin beginning a little behind the ventrals. Lateral line developed for about half the length. Coloration dark, a dark lateral band, above this a pale shade, the belly pale. Head $4\frac{1}{5}$; depth $4\frac{1}{2}$. D. 8; A. 7; scales 6–38–4; teeth 5–4 (or 5–5). L. $2\frac{1}{4}$ inches. Holston River. (*Cope.*)

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 462.)

** Teeth 4–4. (*Chriope* Jor.)

199. H. bifrenata Cope.

Body rather slender, the caudal peduncle somewhat contracted. Head moderate, the muzzle very obtuse. Mouth oblique, the jaws about equal. Upper lip opposite lower part of pupil. Eye large, 3 in head, longer than muzzle. Lateral line developed for a very short distance only. Thirteen scales before dorsal. Straw-colored, the scales brown-edged above. A shining black band from snout through eye to caudal. An orange band above this on the snout. Regions below the black band silvery. Head $4\frac{1}{5}$; depth $4\frac{1}{5}$. D. 8; A. 7; scales 5–36–3; teeth 4–4. L. $1\frac{1}{2}$–2 inches. Massachusetts to Maryland. A small but very handsomely colored species.

(*Hybopsis bifrenatus* Cope, Cypr. Penn. 1866, 384.)

200. H. maculata Hay.

Body long and slender, slightly elevated at the dorsal, somewhat compressed. Head flattened above. Snout rounded. Mouth small, terminal, slightly oblique, maxillary not reaching to opposite eye. Eye

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* *Chriope* Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 1878, 787: type *Hybopsis bifrenatus* Cope. (χρεία, want; ὀπή, pore.)

equal to snout, 3½ in head. Dorsal slightly behind ventrals, nearer snout than base of caudal. Lateral line with pores on 8 or 10 scales only. Straw-color; a narrow dark dorsal band, and a dark streak on each side of anal. A plumbeous lateral band, and black specks on each scale. A black spot as large as the eye at base of caudal. Head 4½; depth 5. D. 8; A. 8; scales 5–38–3; teeth 4–4, with grinding surface. L. 2½ inches. Chickasawha River, Mississippi. (*Hay.*)

(Hay, Proc. U. S. Nat. Mus. 1880, 505.)

201. H. heterodon Cope.

Body moderately stout, the back compressed and somewhat elevated. Head rather pointed, the muzzle acuminate. Mouth oblique, the lower jaw projecting, the upper lip opposite the upper rim of pupil. Maxillary extending to opposite front of orbit. Thirteen scales in front of dorsal. Eye 3 in head. Color olivaceous. A blackish dorsal band. Sides with a leaden or dusky band. D. 8; A. 8. Scales 5–36–3, the lateral line extending about half the length of the body. Teeth 4–4, often crenate. L. 2½ inches. Michigan and Wisconsin.

(*Alburnops heterodon* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 281: *Hybopsis heterodon* Cope, Cypr. Penn. 382: *Leuciscus heterodon* Günther, vii, 261: *Hemitremia heterodon* Jordan, Man. Vert. 303.)

84.—CLIOLA Girard.

Silver Fins.

(*Codoma, Cyprinella, Moniana,* and *Hudsonius* Girard; *Photogenis* and *Hybopsis* Cope; *Graodus* Günther; *Erogala* Jordan.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 192: type *Ceratichthys vigilax* Bd. & Grd.)

Body ovate, oblong, or elongate, usually compressed. Mouth normal, usually rather small. No barbels. Scales various, commonly large, often closely imbricated. Lateral line complete, usually decurved. Dorsal fin generally more or less behind ventrals. Anal short or rather elongate. Teeth 4–4, or 1, 4–4, 0, or 1, 4–4, 1* (1, 4–4, 2 in one species), hooked, with or without grinding surface, the edge often more or less serrate. Intestinal canal short. Peritoneum mostly pale. Males in spring usually prickly, with the fins charged with red or white pigment. A very large group of small fishes, usually brilliantly colored; abundant in all our Southern and Eastern rivers, and extending southward to Western Mexico.† All are American. (A coined name.)

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* Said to be 1, 3–3, 1 in one species, *C. cobitis.* If this be true, the latter species will form the type of a distinct genus, *Tiaroga* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 204: type *Tiaroga cobitis* Girard. (A coined name.)

†(*a.*) *C. alta* Jordan. Body moderately elongate, compressed, deep, the back somewhat elevated. Head short, somewhat depressed above, moderately pointed. Eye moderate, shorter than snout, 5–6 in head. Mouth medium, oblique, terminal,

The species may be divided as follows:*

§ Scales not especially deeper than long; not closely imbricated.
* Teeth 4–4; species of small size.
† Teeth with grinding surface more or less developed. (HYBOPSIS Cope, non Ag.)
(*a.*) Scales in the lateral line more than 45 ..... *alta, sallæi.*
a. Scales in the lateral line 43 or 44 ..... *tuditana, taurocephala, hæmatura.*
aa. Scales in the lateral line 32–37.
spectruncula, nubila, fretensis, longirostris, straminea. volucella, microstoma, lineolata, missuriensis, procne.
†† Teeth without grinding surface. (CLIOLA.)
b. A black spot on anterior edge of dorsal and one at the base of the caudal. *vigilax.*
bb. No black spot on anterior edge of dorsal ..... *chlora, nigrotæniata.*
** Teeth two-rowed.
‡ Teeth without grinding surface ..... *cobitis, sima.*
‡‡ Teeth with grinding surface more or less developed. (HUDSONIUS Grd.)
saludana, storeriana, hudsonia, euryopa.
§§ Scales deeper than long, very closely imbricated along sides of the body.
* Teeth 4–4.
† Edges of teeth entire. (CODOMA Girard.)
‡ Teeth with grinding surface developed ..... *iris, jugalis.*
‡‡ Teeth without grinding surface.
a. Dorsal fin inserted notably behind ventrals; head very short and blunt, almost round ..... *vittata, ornata.*
aa. Dorsal fin inserted directly over ventrals; head moderate, subconic. *callisema.*

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the premaxillary on the level of the pupil, the maxillary not reaching the front of the pupil. Jaws equal. Preorbital large. Scales not closely imbricated, 19 in front of dorsal fin. Dorsal over ventrals. Caudal peduncle deep. Bluish, sides silvery, fins plain. Head $4\frac{1}{4}$; depth $3\frac{3}{4}$. D. 8; A. 8; scales 8–46–4; teeth 4–4, with narrow grinding surface. Lake Tupataro, Guanajuato.

(*Hudsonius altus* Jordan, Proc. U. S. Nat. Mus. 1879, 301.)

(*b.*) *C. sallæi* (Günther) J. & G. Caudal peduncle not quite twice as long as deep. No barbels. Snout obtusely conical, longer than the eye, which is one-fifth the length of head. Upper jaw slightly overlapping the lower. Maxillary not extending to eye. Dorsal immediately behind ventrals. Fins short. Brownish green above, minutely dotted with black along the sides. Head 4; depth $3\frac{3}{5}$. D. 7; A. 6; Lat. l. 54; teeth 4–4, long, curved, with grinding surface. Intestinal canal with few convolutions. L. $3\frac{1}{2}$ inches. Cuernavaca, Mexico. (*Günther.*)

(*Ceratichthys sallæi* Günther, vii, 484: *Hudsonius sallæi* Jordan, Proc. U. S. Nat. Mus. 1879, 226.)

(*c.*) *C. nigrotæniata* (Günther) Jor. Body oblong, snout obtuse, convex, longer than the eye. Eye $4\frac{1}{2}$ in head. Mouth subinferior, small, the upper jaw the longer, maxillary not reaching front of orbit. A black lateral band. Head $4\frac{1}{3}$; depth 5. D. 8; A. 8; scales 6–35–3. Teeth probably 4–4, although only 2-2 are present in one of the typical examples, and none at all in the others; no evident grinding surface. L. 4 inches. Atlisco, Mexico.

(*Graodus nigrotæniatus* Günther, vii, 485: *Cliola nigrotæniata* Jordan, Proc. U. S. Nat. Mus. 1879, 226. The accidental loss of the teeth in two of the three typical examples was the occasion of the establishment of the nominal genus *Graodus.*)

* The reader is advised to be cautious in the use of this key. Some characters appear in the adult only, and in other cases their presence is a question simply of degree.

†† Edges of teeth more or less serrate or crenate; dorsal slightly behind ventrals (MONIANA Girard).

gibbosa, forbesi, leonina, lutrensis, deliciosa, aurata, formosa.

** Teeth 1, 4–4, 1.

b. Teeth with the edges serrate or crenate, usually without grinding surface. (CYPRINELLA Girard.)

c. Dorsal fin without conspicuous black blotch on its upper posterior rays.

d. No conspicuous black spot at base of caudal.

e. Body very deep, compressed, the depth forming about a third of the length.....*umbrosa, bubalina, gunnisoni.*

ee. Body slenderer, the depth 3½–4¼ in length.

suavis, lepida, billingsiana, macrostoma, ludibunda.

dd. A conspicuous black spot at base of caudal.....*notata, venusta.*

cc. Dorsal fin elevated, with a conspicuous black blotch on its posterior rays (often obsolete in the young).

f. A conspicuous black spot at base of caudal .....*calliura.*

ff. No conspicuous black spot at base of caudal.

g. Teeth without grinding surface .....*whipplei.*

gg. Teeth with narrow grinding surface.....*analostana.*

bb. Teeth with entire edges in the adult. (EROGALA Jordan.)

h. Teeth with narrow grinding surface; anal short.

galactura, eurystoma, nivea.

hh. Teeth without distinct grinding surface.

j. Anal fin short, of 8 or 9 rays.

k. A conspicuous dark blotch on upper posterior rays of dorsal.

l. Adult males with the fins chiefly red; a conspicuous black spot at base of caudal...*callistia, trichroistia.*

ll. Adult males without red.

m. A very conspicuous black spot at base of caudal.

stigmatura.

mm. No conspicuous black spot at base of caudal.

cærulea, chloristia.

kk. No dark blotch on upper posterior part of dorsal.

zonata.

jj. Anal fin long, of 10 or 11 rays; fins high.

xænura, pyrrhomelas, hypseloptera.

§ Scales not especially deeper than long, not closely imbricated.

* Teeth 4–4; species of small size.

† Teeth with grinding surface more or less developed.* (*Hybopsis* Cope, *non* Agassiz.)

a. Scales in the lateral line 43 or 44.

202. C. tuditana (Cope) J. & G.

Form and general appearance of *Hyborhynchus notatus*. Head flat above. Muzzle very obtuse. Mouth small, inferior, horizontal. Fins low. Scales rather small, 27 in front of the dorsal. Olivaceous above; dorsal scales narrowly black-edged; no vertebral band; sides and below silvery; usually a dusky band along sides, ending in a dark caudal

* Several of the species in this section are of doubtful validity, and some of them may prove to belong to *Hybognathus*.

spot; a dark spot near the base of the dorsal in front, as in *Hyborhynchus*. Head 4½; depth 5. D. 8; A. 7; scales 7–44–4; teeth 4–4, little hooked. L. 3 inches. Michigan to Indiana.

(*Hybopsis tuditanus* Cope, Trans. Amer. Phil. Soc. Phila. 1866, 381: *Leuciscus tuditanus* Günther, vii, 259.)

203. C. taurocephala (Hay) J. & G.—*Bull-head Minnow.*

Body stout, somewhat compressed, broad and flat above, with deep caudal peduncle. Head broad and flat above, with an angle at the temporal region. Muzzle broad and obtuse, less truncate than in *Hyborhynchus notatus*. Mouth rather small, horizontal, terminal, the jaws about equal, maxillary not reaching to opposite anterior margin of eye. Eye large, 3½ in head. Dorsal inserted above ventrals, nearer snout than caudal. Scales before dorsal small, in about 27 series. Dusky yellowish; sides silvery, with an obsolete dark lateral band, which terminates in a black spot; a black spot on anterior rays of dorsal fin. Depth 4½; head 4½. D. 8; A. 7; scales 8–43–4; teeth 4–4, with grinding surface. L. 3 inches. Chickasawha River, Mississippi.

(*Alburnops taurocephalus* Hay, Proc. U. S. Nat. Mus. 1880, 503.)

204. C. hæmatura (Cope) J. & G.

Head moderate, the muzzle little obtuse. Mouth larger, terminal, oblique, the maxillary reaching the orbit. Eye 3½ in head; temporal region rounded. Scales rather small, 21 rows in front of the dorsal. Lateral line slightly decurved. Plumbeous above; head blackish; a faint dusky lateral band, ending in a dusky spot at root of caudal fin; caudal fin dull red; fins otherwise plain. Head 4; depth 4⅘. D. 8; A. 7; scales 7–44–4; teeth 4–4, little hooked. L. 3 inches. Michigan to Illinois; not very common.

(*Hybopsis hæmaturus* Cope, Cypr. Penn. 382, 1866: *Leuciscus hæmaturus* Günther, vii, 259.)

aa. Scales in the lateral line 32–37.

205. C. spectruncula (Cope) J. & G.

Body elongate. Head large and rather flat, nearly as broad as deep Eye large, 3 in head. Muzzle remarkably thick. Mouth slightly oblique, the maxillary reaching the eye. Fifteen rows of scales in front of dorsal. Olivaceous, silvery white below; a leaden band along the sides and a conspicuous black spot at base of caudal; head dusky; margins of scales above lateral line, as well as bases of dorsal and anal fins, blackish; pectorals, ventrals, dorsal, and anal more or less orange in

life. Head 4; depth $5\frac{1}{2}$. D. 8; A. 9; Lat. l. 37; teeth 4–4. L. 3 inches. Headwaters of Holston River. (*Cope.*)

(*Hybopsis spectrunculus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 231.)

206. C. nubila (Forbes) J. & G.

Head narrow. Mouth inferior and horizontal. Lateral line anteriorly deflexed. Eye large, 3 in head, rather longer than muzzle. Fourteen scales before dorsal. Color very dark; a dark lateral band from muzzle to base of caudal; fins all plain. Head $4\frac{1}{2}$; depth 4. D. 8; A. 9; scales 5–37–3; teeth 4–4, little hooked. L. $2\frac{1}{4}$ inches. Rock River, Illinois.

(*Alburnops nubilus* Forbes, Bull. Ills. Lab. Nat. Hist. ii, 56, 1878.)

207. C. fretensis (Cope) J. & G.

Body slender and compressed, resembling *Minnilus*. Head convex between orbits. Mouth quite oblique, the middle of the premaxillary being opposite the line of the pupil; maxillary not reaching to orbit. Eye $3\frac{1}{2}$ in head. Seventeen rows of scales in front of dorsal. Lateral line decurved. Olivaceous; a dark median dorsal band; a plumbeous silvery lateral shade; cheeks silvery; a dark spot at base of caudal; fins plain. Head 4; depth 5. D. 8; A. 8; scales 6–35–3; teeth 4–4. L. $2\frac{1}{2}$ inches. Michigan to Illinois.

(*Hybopsis fretensis* Cope, Cypr. Penn. 382, 1866.)

208. C. longirostris (Hay) J. & G.

Form of *Ericymba buccata*. Head rather small. Eye shorter than snout, 4 in head. Upper jaw rounded, considerably projecting beyond the lower jaw. Mouth rather large, horizontal, maxillary extending to opposite anterior margin of the eye. Scales large; about 12 large scales in front of the dorsal. Origin of dorsal midway between tip of snout and base of caudal, directly over ventrals. Pectorals not reaching ventrals; the latter to vent. Straw-color, with an obsolete lateral band and a narrow dorsal streak; fins dusky. Head $4\frac{1}{4}$. D. 8; A. 7; scales 4–36–3; teeth 4–4, with grinding surface. Chickasawha River, Mississippi.

(*Alburnops longirostris* Hay, Proc. U. S. Nat. Mus. 1880, 504.)

209. C. straminea (Cope) J. & G.—*Straw-colored Minnow.*

Body moderately stout, little compressed. Head rather broad, with rounded angles. Mouth small, inferior, horizontal. Snout very obtuse. Eye large, 3 in head. Fifteen rows of scales in front of dorsal fin. Pale olivaceous; sides little silvery; usually a darker dorsal band; fins

all plain. Head 4; depth 5. Scales 5–36–4; teeth 4–4. L. 2½ inches. Ohio Valley and lake region; generally abundant in small streams. One of the most insignificant of all our fishes.

(*Hybognathus stramineus* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 283: *Hybopsis stramineus* Cope, Cypr. Penn. 381.)

210. C. volucella (Cope) J. & G.

Body moderately stout. Head depressed, elongate, the vertex plane, the muzzle elongate. Fins more elongate than in most of the related species, the pectorals reaching the ventrals. Caudal peduncle slender. Eye 3⅓ in head. Olivaceous, a slight dusky lateral shade; no dorsal stripe; fins plain. Head 3¾; depth 4. D. 8; A. 8; scales 4–34–3; teeth 4–4. L. 2½ inches. Michigan and Wisconsin.

(*Hybognathus volucellus* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 283: *Hybopsis volucellus* Cope, Cypr. Penn. 381: *Leuciscus volucellus* Günther, vii, 260.)

211. C. microstoma (Raf.) J. & G.

Body elongate, the caudal peduncle not contracted. Mouth inferior, horizontal, small, the maxillary not reaching the line of the eye. Fins rather short. Eye large, 3½ in head. Fourteen scales before dorsal. Preorbital bone much longer than deep. Olivaceous, translucent; a silvery lateral band, along which is a black speck at the origin of each tube of the lateral line. D. 8; A. 7; scales 5–33–2; teeth 4–4. L. 2½ inches. Virginia to Kentucky.

(*Minnilus microstomus* Raf. Ichth. Oh. 1820, 47: *Hybopsis longiceps* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 231.)

212. C. lineolata (Agassiz) J. & G.

Body slender. Head short. Muzzle obtuse. Mouth slightly oblique, the jaws equal, the maxillary reaching to eye. Lateral line slightly decurved. Olivaceous, sides silvery, with dark points along the lateral line, these especially abundant along the sides of the muzzle. Head 4½; depth 4⅗. D. 8; A. 7; scales 6–34–4; teeth 4–4. L. 2 inches. Nebraska to Colorado. (*Cope.*) Osage River. (*Agassiz.*)

(*Alburnus lineolatus* Agassiz, Bull. Mus. Comp. Zoöl. 1863, 9: *Leuciscus lineolatus* Günther, vii, 260: *Hybopsis scylla* Cope, Hayden's Geol. Surv. Wyom. 1872, 438.)

213. C. missuriensis (Cope) J. & G.

Body stout, with large head and thick caudal peduncle. Mouth subinferior, somewhat oblique, end of maxillary reaching line of orbit. Twelve scales in front of the dorsal fin. Fins rather long. Eye large, 3 in head. Coloration very pale olivaceous; a silvery lateral band and some dusky specks at base of caudal; no dark dorsal line; fins plain.

Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. A. 7; scales 5–31–3; teeth 4–4. L. $2\frac{1}{2}$ inches. Missouri to the Rio Grande; probably abundant.

(*Hybopsis missuriensis* Cope, Hayden's Geol. Surv. Wyom. for 1870, 1872, 437.)

214. C. procne (Cope) J. & G.

Body slender, with long caudal peduncle. Muzzle obtuse. Mouth horizontal, inferior, small. Thirteen rows of scales in front of the dorsal. Depth of caudal peduncle one-fourth its length. Eye large. Olivaceous; a dark dorsal line and a plumbeous lateral band overlying black pigment; fins unspotted. Head $4\frac{3}{4}$; depth $5\frac{1}{4}$. Scales 5–32–3; teeth 4–4; A. 7. L. $2\frac{1}{2}$ inches. Delaware and Susquehanna Rivers. One of the smallest of the *Cyprinidæ*.

(*Hybognathus procne* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 279: *Hybopsis procne* Cope, Cypr. Penn. 385: *Leuciscus procne* Günther, vii, 260.)

†† Teeth without grinding surface. (*Cliola.*)

b. A black spot on the anterior edge of the dorsal and one at the base of the caudal.

215. C. vigilax B. & G.

Body subfusiform, compressed, not elevated. Head conical, bluntish. Mouth rather small, oblique, the jaws equal, the maxillary not extending to the eye. Eye moderate, $3\frac{1}{2}$ in head. Isthmus rather broad. Fins small; the dorsal longer than high. Scales large, somewhat higher than long, 16 in a transverse series from dorsal to ventral. Color brownish; a dusky stripe composed of crowded dots along the lateral line; a black spot at base of caudal, and one on the anterior rays of dorsal. Head 4; depth $4\frac{3}{4}$. D. 9; A. 8; Lat. l. 36; "teeth 4–4, without grinding surface". L. 3 inches. Arkansas to Texas. (*Girard.*)

(*Ceratichthys vigilax* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 390: *Cliola vigilax, velox,* and *vivax* Girard, Proc. Acad. Nat. Sci. Phila. 1853, 192, and in U. S. Pac. R. R. Surv. x, 257, 258. *C. vivax* is said to have scales "a good deal smaller", but no data are given. The types of all three are now lost.)

hh. No black spot on anterior edge of dorsal.

216. C. chlora Jordan.

Body slender, compressed. Head rather small. Eye large, about 3 in head, longer than snout. Mouth rather small, quite oblique, the lower jaw included when the mouth is closed, the maxillary scarcely reaching the front of orbit. Scales very large, about 12 in front of the dorsal fin; the body entirely scaly except the thoracic region. Lateral line somewhat decurved. Dorsal fin beginning directly over ventrals. Color pale; back greenish; belly white; side with a silvery band; no spots on fins and no dusky or plumbeous shading on the body, except

sometimes a small dark spot at base of caudal. Head $4\frac{1}{4}$; depth 5. D. 7; A. 7; scales 4–35–3; teeth 4-4, without grinding surface. L. $2\frac{3}{4}$ inches. Upper Missouri region.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 791, 1878.)

** Teeth two-rowed.

‡ Teeth without grinding surface.

217. C. cobitis (Grd.) J. & G.

Body moderately elongate, subfusiform, compressed. Head small, subconical, depressed. Mouth small, terminal, oblique, without barbels, the maxillary falling far short of eye; lower jaw included. Eye moderate, high up, midway in head; isthmus very wide. Ventrals slightly in advance of dorsal. Fins all high. Lateral line nearly straight. Body olivaceous, with dusky specks above; a black spot at base of caudal. Head 4; depth $4\frac{1}{4}$. D. 8; A. 7; Lat. l. 65. Teeth without grinding surface, 1, 3–3, 1, *fide* Girard.* L. $2\frac{1}{2}$ inches. Rio Gila. (*Girard.*)

(*Tiaroga cobitis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 204, and U. S. Mex. Bound. Surv. Ichth. 60: *Leuciscus cobitis* Günther, vii, 247.)

218. C. sima (Cope) Jor. & Gilb.

Body robust. Head short and broad, with short, decurved muzzle. Mouth large, oblique, the upper lip below the level of the pupil, the maxillary extending past the front of orbit. Eye moderate, $4\frac{1}{5}$ in head. Fins large, the dorsal well behind ventrals. Coloration entirely silvery, brightest on the sides. Head $4\frac{1}{5}$; depth $4\frac{1}{5}$. D. 8; A. 9; scales 8–35–4, 22 series in front of the dorsal fin; teeth 1, 4–4, 1. L. $3\frac{1}{2}$ inches. Rio Grande at San Ildefonso, New Mexico. (*Cope.*)

(*Alburnellus simus* Cope, Zoöl. Lieut. Wheeler's Expl. W. 100th Mer. v, 649, 1876.)

‡‡ Teeth with grinding surface more or less developed. (*Hudsonius* Girard.†)

219. C. saludana Jor. & Brayt.

Body elongate, but less so than in *C. storeriana*, moderately compressed. Caudal peduncle long. Head large, rather heavy and gibbous forward, the muzzle rounded in profile. Eye large, $3\frac{1}{4}$ in head. Mouth moderate, subinferior, the maxillary not reaching to the eye. Scales large, thin and loose, about 12 in front of the dorsal fin. Lateral line somewhat decurved in front. Fins rather small, pectorals not reaching to ventrals, the latter not to vent. Coloration pale olivaceous, nearly

* If this number of teeth is normal and not merely due to accident, this species of course does not belong to *Cliola*.

† Girard, Proc. Acad. Nat. Sci. Phila. 1856, 210: type *Clupea hudsonia* De Witt Clinton. (The name from Hudson River.)

white, with traces of a plumbeous lateral streak. Head $4\frac{1}{2}$; depth $4\frac{1}{2}$. D. 8; A. 8; scales 5–39–3; teeth 1, 4–4, 1, two or three of the teeth obtuse, not hooked, only one or two of them showing a masticatory surface. L. 4 inches. Santee Basin, North and South Carolina.

(*Alburnops saludanus* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 16, 1878.)

220. C. storeriana (Kirt.) J. & G.

Body elongate, considerably compressed in the adult. Head quite short. Muzzle blunt, decurved, shorter than the very large eye, which is 3 in head. Top of head flattened, somewhat concave between orbits. Greatest depth of head nearly three-fourths its length. Mouth moderate, nearly horizontal, the jaws nearly equal, the maxillary extending to the eye. Lateral line nearly straight, slightly decurved anteriorly. Eighteen scales before dorsal. Coloration very pale, sometimes a dusky spot at base of caudal, especially in the young. Sides with a broad silvery band. Pectorals not reaching ventrals, the latter not to vent. Caudal fin long, the lower lobe the longer, dusky, with a pale edge. Head $4\frac{3}{4}$; depth 4. D. 8; A. 8; scales 5–39–4; teeth 1, 4–4, 0 or 1. L. 4–8 inches. Great Lake region to South Carolina. One of our largest minnows. Perhaps more than one species is here included, but we fail to distinguish with any certainty the Eastern *amara* from the lake form (*storeriana*), from which the above description was taken.

(*Rutilus storerianus* Kirtland, Proc. Bost. Soc. Nat. Hist. i, 71, 1842: *Hudsonius amarus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 210: *Hybopsis storerianus* Cope, Cypr. Penn. 386: *Leuciscus storerianus* Günther, vii, 250.)

221. C. hudsonia (Clinton) J. & G.—*Spawn-eater.*

This species scarcely differs from the foregoing except in the somewhat darker coloration, the black caudal spot being usually distinct, and in the dentition, several specimens examined having the teeth 2, 4–4, 1, instead of 1, 4–4, 0, as in the preceding. The proportions, scales, and fin-rays seem to be the same, and the form of the head and mouth do not essentially differ. Streams coastwise, New York to Virginia.

(*Clupea hudsonia* De Witt Clinton, Ann. Lyc. Nat. Hist. N. Y. i, 49, 1824: *Hudsonius fluviatilis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 210: *Hybopsis hudsonius* Cope, Cypr. Penn. 386: *Leuciscus hudsonius* Günther, vii, 250.)

222. C. euryopa (Bean) J. & G.

Silvery, with a black lateral band. Eye large, 3 in head. Head $4\frac{1}{4}$; depth 5. D. 8; A. 8; scales 6–38–5; teeth 1, 4–4, 1, with narrow grinding surface. Savannah River.

(*Hudsonius euryopa* Bean, Proc. U. S. Nat. Mus. 1879, 285.)

§§ Scales deeper than long, very closely imbricated along sides of the body.

* Teeth 4–4.

† Edges of teeth entire. (*Codoma.**)

‡ Teeth with grinding surface developed.

223. C. iris (Cope) J. & G.

Body deep, compressed, as in *Cyprinella*. Dorsal outline well arched. Mouth moderate, oblique, the jaws subequal. Eye moderate, 4 in head. Scales very narrowly exposed on the sides, the lateral line decurved. Seventeen rows of scales in front of dorsal fin, which is inserted behind ventrals; pectoral fin reaching ventrals; ventrals reaching anal; dorsal and caudal short. Males in spring with the snout in front tuberculate. Color bright, clear green above; a green band extending down behind operculum; head and belly vermilion-red; a large, square vermilion spot behind the green scapular stripe. Lower fins crimson; caudal vermilion; dorsal olivaceous, unmarked. Females plain olivaceous and silvery. Head $3\frac{3}{4}$; depth $3\frac{1}{4}$. D. 8; A. 9; scales 5–33–3; teeth 4–4. L. $2\frac{1}{2}$ inches. Upper Rio Grande. The most brilliantly colored fish in New Mexico. (*Cope.*)

(*Hypsilepis iris* Cope, Wheeler's Expl. W. 100th Mer. v, 653, 1876.)

224. C. jugalis (Cope) J. & G.

Form stout, compressed. Back much elevated, descending steeply to the end of the muzzle. Upper jaw rather the longer, maxillary reaching beyond the front of the orbit. Eye moderate, $4\frac{1}{4}$ in head. Pectorals nearly reaching ventrals. Sides and lower fins milky white; a dusky shade on dorsal fin; a broad dark vertical bar behind head; a dusky shade on the side between ventrals and anal. The coloration, therefore, essentially that of the species of the group *Photogenis*. Head 4; depth 3. D. 8; A. 9; scales 7–34–4; teeth 4–4 (said to be 1, 4–4, 1 in young specimens), with rather narrow grinding surface. L. $2\frac{1}{2}$ inches. Missouri River and Arkansas River. (*Cope.*)

(*Moniana jugalis* Cope, Hayden's Geol. Surv. Wyom. for 1870, 1872, 439.)

‡‡ Teeth without grinding surface.

a. Dorsal fin inserted notably behind ventrals; head very short and blunt, almost round.

225. C. vittata (Grd.) J. & G.

Body rather stout, heavy anteriorly, with long caudal peduncle; the back not arched. Head blunt and heavy, but less gibbous than in *C. ornata*. Mouth moderate, quite oblique, the maxillary not reaching to the eye. Eye rather small, nearly 5 in head. Scales rather small.

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* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 194: type *Codoma vittata* Grd. (A coined name.)

Fins low. Lateral line somewhat decurved. Color dark above, below this a silvery band, and below this a dusky shade; fins in the typical specimens plain. Head 4; depth $3\frac{4}{5}$. D. 8; A. 8; Lat. l. 53. L. 3 inches. Valley of Mexico.

(*Codoma vittata* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 195, and U. S. Mex. Bound. Surv. Ichth. 53.)

226. C. ornata (Grd.) J. & G.

Body stout and compressed, the head very blunt, thick, and rounded. Mouth small, nearly horizontal, the jaws equal. Eye large, anterior, $3\frac{3}{4}$ in head. Scales deep, closely imbricated, the lateral line decurved. Dorsal a little behind ventrals. Fins all rather small. Snout prickly in the spring males. Color dark; sides with about 8 more or less conspicuous cross-bars; fins all with the middle part dusky or black, the tips milk-white, the pectorals and the anal notably so. Head $4\frac{1}{8}$; depth $3\frac{1}{6}$. D. 8; A. 7; Lat. l. 39; teeth 4–4. L. $2\frac{1}{2}$ inches. Chihuahua.

(*Codoma ornata* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 195, and U. S. Mex. Bound. Surv. Ichth. 53.)

aa. Dorsal fin inserted directly over ventrals; head moderate, subconic.

227. C. callisema Jordan.

Body rather elongate, fusiform, compressed. Head elongate, the muzzle rather blunt, projecting over the moderate-sized, oblique mouth; maxillary not reaching to opposite the eye. Eye moderate, $4\frac{1}{4}$ in head. Scales firm, closely imbricated, 15 in front of the dorsal. Dorsal fin extremely high; its height in the males one-fourth of the length of the body, in the females somewhat lower; its insertion almost directly over the first ray of the ventrals. In all the other similarly colored species of *Cliola* the dorsal is evidently behind the ventrals. Coloration brilliant, clear dark blue above, sides and below abruptly silvery; a blue lateral streak, much as in *C. cærulea*, bounding the blue of the upper parts, the white pigment of the lower parts looking as if painted over the blue. Dorsal with a large black spot on its last rays above. Dorsal, anal, and caudal with the usual satin-white pigment at their tips; these fins otherwise of a clear, bright ferruginous orange. Females slender and dull-colored. Head 4; depth $4\frac{2}{5}$. D. 8; A. 8; scales 6–39–3; teeth 4–4. L. $2\frac{3}{4}$ inches. Ocmulgee River, Georgia. An elegant fish, allied to the species of *Erogala*.

(*Episema callisema* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 363: *Codoma callisema* Jordan, Bull. U. S. Nat. Mus. xii, 52.)

†† Edges of teeth more or less serrate or crenate; dorsal fin slightly behind ventrals.

(*Moniana* Girard.*)

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* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 199: type *Leuciscus lutrensis* B. & G. (A coined name.)

228. C. gibbosa (Grd.) J. & G.

Body extremely deep and compressed, the back much arched, espepecially anteriorly. Head short, blunt and deep, the profile continuous from the snout to the occiput without angle. Muzzle short and blunt. Eye small, $3\frac{3}{4}$ in head. Mouth quite small, very oblique, the upper lip on the level of the pupil, the maxillary not extending quite to the orbit. Scales large, the lateral line very much decurved. Dorsal fin well behind ventrals; lower fins rather large, the pectorals nearly reaching ventrals, the latter to vent. Bluish above; sides silvery; lower fins milky; a more or less distinct black spot between the rami of the lower jaw. Males tuberculate in spring. Head 4; depth $2\frac{5}{6}$. D. 8; A. 9; scales 6–34–3; teeth 4–4. L. $2\frac{1}{2}$ inches. Rio Grande.

(*Moniana gibbosa* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 201: *Cyprinella complanata* Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 3, 665, 1878.)

229. C. forbesi Jordan.—*Forbes's Red-fish.*

Body oblong, elevated, strongly compressed, the back arched. Caudal peduncle rather slender. Head stout and deep, its upper outline depressed, the nape elevated, forming an angle, so that the profile is somewhat concave. Mouth rather large, quite oblique, the lower jaw included. Eye small, 4 in head. Lateral line strongly decurved. Thirteen scales in front of dorsal. Males profusely tuberculate in spring. Colors in life brilliant, steel-blue; the lower region silvery; the belly orange-red in the males; a conspicuous violet-colored crescent behind the shoulders, followed by a crimson crescent; fins reddish, the anal and caudal blood-red; chin without black spot. Head $3\frac{2}{3}$; depth 3. D. 7; A. 8; scales 6–35–2; teeth 4–4. L. $2\frac{3}{4}$ inches. Streams of Southern Illinois. Very near the preceding, but distinguished by the form of the profile and the coloration.

(*Cyprinella forbesi* Jordan, Bull. Ills. State Lab. Nat. Hist. ii, 57, 1878.)

230. C. leonina (Grd.) J. & G.

Body rather short and deep, compressed, with long caudal peduncle. Head moderate, the snout subconical, moderately pointed. Mouth rather large, oblique, the maxillary scarcely extending to the orbit. Eye moderate, 4 in head. Lateral line decurved. Head $4\frac{1}{8}$; depth $3\frac{1}{2}$. D. 9; A. 9; Lat. l. 40. L. $3\frac{1}{4}$ inches. Rivers of Texas and Northern Mexico. (*Girard.*)

(*Moniana leonina, complanata,* and *frigida* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 199, 200.)

231. C. lutrensis (B. & G.) J. & G.

Body rather short and thick-set, the back not greatly arched. Head rather heavy, the muzzle blunt. Mouth moderate, the jaws equal, the maxillary not reaching orbit. Lateral line decurved. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. 7; A. 9; Lat. l. 36; 12 scales in a transverse series. Arkansas and Red Rivers. (*Girard.*)

(*Leuciscus lutrensis* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 391: *Moniana lutrensis* and *pulchella* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 199, 200: *Leuciscus lutrensis* Günther, vii, 258.)

232. C. deliciosa (Grd.) J. & G.

Body elliptical, moderately compressed. Head shortish, rather blunt, the profile forming an even curve. Mouth moderate, oblique, the maxillary not reaching to the eye. Lateral line somewhat decurved. Eye moderate, $3\frac{1}{2}$ in head. Scales rather large. Head 4; depth $3\frac{1}{2}$. D. 8; A. 8; Lat. l. 33. L. $2\frac{1}{2}$ inches. Streams in the Rio Grande region. (*Girard.*) More than one species may be here included, but, if so, they cannot be recognized from Dr. Girard's descriptions. Of all of Girard's *Monianæ* the types of only *lutrensis* and *proserpina* can now be found.

(*Moniana deliciosa, proserpina, lætabilis, couchi, rutila, nitida*, and *gracilis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 199–201.)

233. C. aurata (Grd.) J. & G.

Body subfusiform, compressed, little elevated. Caudal peduncle rather slender. Head rather blunt and heavy. Mouth small, oblique, the upper jaw projecting, maxillary not reaching to the eye; upper lip below the level of the pupil. Lateral line little decurved. A dusky streak along sides. Head $3\frac{3}{4}$; depth 4. D. 8; A. 8; Lat. l. 37. L. $2\frac{1}{2}$ inches. Piedrapainte, New Mexico. (*Girard.*)

(*Moniana aurata* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 200.)

234. C. formosa (Girard) J. & G.

Body elliptic, compressed. Head small, rather slender and pointed. Mouth moderate, oblique, the maxillary barely reaching orbit; upper lip on the level of the pupil. Eye large, 4 in head. Lateral line decurved. Scales small. Dorsal fin rather high. Head $4\frac{1}{8}$; depth $3\frac{3}{4}$. D. 8; A. 9; Lat. l. 49. L. $2\frac{1}{4}$ inches. Rio Mimbres, Mexico. (*Girard.*) If we may trust Girard's figure, this species is well distinguished by the small size of the scales.

(*Moniana formosa* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 201.)

** Teeth 1, 4–4, 1.

b. Teeth with edges more or less serrate or crenate (usually without grinding surface). (*Cyprinella* Girard.*)

c. Dorsal fin without conspicuous black blotch on its upper posterior rays.

d. No conspicuous black spot at base of caudal.

e. Body very deep, compressed, the depth forming about a third of the length.

235. C. umbrosa (Grd.) J. & G.

Body short, the back very much arched. Caudal peduncle robust. Head short and deep, bluntish. Eye large, 4 in head. Mouth moderate, quite oblique, the jaws about equal, the maxillary nearly reaching the front of the eye; the upper lip on the level of the pupil. Lateral line decurved. Fins rather low. Coloration plain in spirits. Head $4\frac{1}{8}$; depth 3. D. 8; A. 9; scales 8–42–5. L. $3\frac{1}{2}$ inches. Arkansas, etc. (*Girard.*)

(*Cyprinella umbrosa* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 197, and U. S. Pac. R. R. Surv. x, 266.)

236. C. bubalina (B. & G.) J. & G.

Form of the preceding, but the caudal peduncle slender. Eye large, $3\frac{1}{2}$ in head. Jaws equal. Lateral line decurved. This species appears to differ from the preceding chiefly in its larger scales. Head 4; depth 3. D. 8; A. 9; scales 6–36–3. L. 3 inches. Red River, Arkansas. (*Girard.*)

(*Leuciscus bubalinus* B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 391: *Cyprinella bubalina* Girard, U. S. Pac. R. R. Surv. x, 265: *Cyprinella beckwithi* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 267.)

237. C. gunnisoni (Grd.) J. & G.

Body short and compressed, the back arched, but less so than in the preceding. Head small. Caudal peduncle moderate. Maxillary reaching nearly to eye. Eye moderate, $3\frac{1}{2}$ in head. Ventrals in advance of dorsal. Coloration plain in spirits. Head $4\frac{1}{3}$; depth 3. D. 8; A. 9; Lat. l. 34. L. $2\frac{1}{2}$ inches. Cottonwood Creek, Utah.

ee. Body slenderer, the depth $3\frac{1}{2}$–$4\frac{1}{4}$ in length.

238. C. suavis (Grd.) J. & G.

Body short, compressed, the back slightly arched. Mouth oblique. Eye 4 in head. Maxillary not quite reaching eye. Scales moderate. Lateral line gently curved. Coloration plain in spirits. "By its general form and appearance this species establishes a transition between

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* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 196: type *Leuciscus bubalinus* Baird & Girard. (Latin *cyprinella*, a little carp.)

the deep and slender species." Head $4\frac{1}{4}$; depth $3\frac{1}{2}$. D. 8; A. 9. San Antonio, Texas. (*Girard.*)

(*Cyprinella suavis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 197.)

239. C. lepida (Grd.) J. & G.

Body stout, fusiform. Caudal peduncle robust. Head heavy. Snout rather blunt. Mouth oblique, the maxillary not reaching quite to eye. Eye moderate, 4 in head. Lateral line decurved. Scales larger than in any of the preceding. Colors plain in spirits. Head $3\frac{1}{2}$; depth $3\frac{3}{4}$. D. 8; A. 9; scales 6–34–4. Rio Frio, Texas. (*Girard.*)

(*Cyprinella lepida* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 197, and U. S. Pac. R. R. Surv. x, 268.)

240. C. billingsiana (Cope) Jor. & Gilb.

Body stout, fusiform. Mouth slightly oblique, the jaws equal, maxillary reaching orbit. Eye $3\frac{1}{2}$ in head. Dorsal considerably behind ventrals. Coloration plain in spirits. Head 4; depth 4. D. 8; A. 8; scales 6–31–3; teeth 1, 4–4, 1. L. 2 inches. Missouri River, at Saint Joseph. (*Cope.*) "Dedicated to Joshua Billings, esq., author of original observations on 'The Briny Codfish'."

(*Cyprinella billingsiana* Cope, Hayden's Geol. Surv. Terr. Wyom. 1870, 1872, 439.)

241. C. macrostoma (Grd.) J. & G.

Body slender, the form being like that of the stouter species of *Minnilus*. Head moderate. Mouth rather large for the genus, oblique, the maxillary reaching front of eye. Eye large. Lateral line somewhat decurved. Dorsal behind ventrals. Brownish above; cheeks and sides bright silvery. Head 4; depth $4\frac{1}{8}$. D. 8; A. 9; Lat. l. 36. Rio Grande region.

(*Cyprinella macrostoma*, *luxiloides*, and *lugubris* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 198, 199.)

242. C. ludibunda (Grd.) J. & G.

Body elongate, subfusiform. Caudal peduncle slender. Eye large, 3 in head. Snout subconical. Mouth nearly horizontal, small, the maxillary not extending to the eye. Silvery; lateral line with black dots. Cottonwood Creek, Utah. (*Girard.*) A dubious species, apparently distinguished from the preceding by the small horizontal mouth.

(*Cyprinella ludibunda* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 199.)

dd. A conspicuous black spot at base of caudal.

243. C. notata (Grd.) J. & G.

Body stoutish, subfusiform. Caudal peduncle slender. Eye moderate, $3\frac{1}{2}$ in head. Snout bluntish. Mouth small, oblique, the maxillary

not reaching to the eye. Ventrals in advance of dorsal. Fins moderate. Coloration plain in spirits, except the black caudal spot; sides silvery. Head $4\frac{1}{3}$; depth $3\frac{2}{3}$. D. 8; A. 7; Lat. l. 46. Rio Seco, Texas. (*Girard.*)

(*Cyprinella notata* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 198, and U. S. Pac. R. R. Surv. x, 269.)

244. C. venusta (Grd.) J. & G.

Body slender, as in *C. macrostoma*. Head long and rather pointed, the snout subconical. Mouth large, oblique, the maxillary scarcely reaching to the eye. Eye large, $3\frac{1}{2}$ in head. Fins moderate; the dorsal behind ventrals. Coloration plain in spirits, except the caudal spot; sides mostly silvery. Head $4\frac{1}{8}$; depth 4. D. 8; A. 8; scales 7–37–3 (36 in type of *C. texana*). Rivers of Texas.

(*Cyprinella venusta* and *texana* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 198, and U. S. Mex. Bound. Surv. Ichth. 54, 55.)

cc. Dorsal fin elevated, with a conspicuous black blotch on its upper posterior rays (obsolete in young examples).

f. A conspicuous black spot at base of caudal.

245. C. calliura Jordan.

Body elongated, compressed, elevated in the middle, the profile before the dorsal curved. Snout projecting, forming a decided angle. Head convex above, densely tuberculate in the males. Muzzle rather pointed, overhanging the oblique mouth. Eye 4 in head, less than muzzle and interorbital width. Dorsal fin inserted slightly behind ventrals. Lateral line strongly decurved, usually forming an abrupt flexure just in front of the ventrals. Color in spirits pale silvery, the dorsal and caudal blotches very strongly marked. Head $4\frac{2}{5}$; depth 4. D. 8; A. 8; scales 6–44–3; teeth 1, 4–4, 1. L. $4\frac{1}{2}$ inches. Rivers of Alabama and Louisiana.

(*Cyprinella calliura* Jordan, Bull. U. S. Nat. Mus. x, 61, 1877.)

ff. No conspicuous black spot at base of caudal fin.

g. Teeth without grinding surface.

246. C. whipplei (Grd.) Jor. & Gilb.

Body moderately elongate, subfusiform. Caudal peduncle stoutish. Head shortish, rather pointed. Eye large, 4 in head. Mouth little oblique, the lower jaw included, maxillary reaching to anterior rim of the orbit; upper lip on a line with lower border of orbit. Dorsal fin very nearly opposite ventrals, greatly elevated, its height in the male more than one-fourth the length; anal fin large. Lateral line little decurved. Coloration in alcohol plain, except the conspicuous dorsal

spot; probably brilliant in life. Head $4\frac{1}{8}$; depth $3\frac{3}{4}$. D. 8; A. 9; scales 6–40–4. Sugar-loaf Creek, Arkansas. (*Girard.*)

(*Cyprinella whipplei* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 198, and U. S. Pac. R. R. Surv. x, 270.)

gg. Teeth with narrow grinding surface. (*Photogenis* Cope.*)

247. C. analostana (Grd.) J. & G.—*Silver-fin.*

Body moderately elongate, somewhat compressed, the dorsal and ventral outlines regularly and gently arched. Head rather short and deep. Mouth rather small, quite oblique, the lower jaw received within the upper when the mouth is closed. Eye small, $4\frac{1}{2}$ in head. Leaden silvery, bluish in the males; edges of scales dusky; a dark vertebral line; a large black spot on the upper posterior part of the dorsal. Paired fins and lower part of belly, as well as the tips of the anal and caudal, and the front and upper parts of the dorsal, charged with clear satin-white pigment in males in the spring; in full breeding dress the dorsal pigment with a greenish lustre; no creamy band at base of caudal; males with the head and front covered with small tubercles. Head $4\frac{1}{4}$; depth 4. D. 8; A. 8; scales 5–38–3; teeth 1, 4–4, **1**, the edges more or less distinctly serrate. L. 4 inches. Pennsylvania and Central New York to Mississippi Valley; abundant.

(*Cyprinella analostana* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 38: *Luxilus kentuckiensis* Kirtland, Bost. Journ. Nat. Hist. v, 27 (not of Raf.): *Hypsilepis kentuckiensis* Cope, Cypr. Penn. 371: *Leuciscus analostanus* Günther, vii, 256: *Photogensis spilopterus* Cope, Cypr. Penn. 378: *Leuciscus spilopterus* Günther, vii, 254.)

bb. Teeth with entire edges (in the adult). (*Erogala* Jordan.†)

h. Teeth with a narrow grinding surface; anal short.

248. C. galactura (Cope) J. & G.—*Milky-tailed Shiner.*

Body fusiform, moderately elongate, not greatly compressed. Mouth rather large, jaws nearly horizontal, the upper projecting beyond the lower. Scales less closely imbricated than in the preceding. Lateral line little decurved. Eye small. Steel blue above, silvery below; dorsal with a black blotch on its posterior rays; caudal fin conspicuously creamy yellow at base, then dusky. Males with the belly, paired fins, and especially the tips of the vertical fins charged with milk-white pigment in the spring, the head and front then covered with small tubercles. In high coloration the anal and caudal are sometimes pale reddish. Fe-

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* Cope, Cypr. Penn. 1866, 378: type *Photogenis spilopterus* Cope = *Cyprinella analostana* Grd. (φὸς, light; γεννάω, to be born.)

† Jordan, Bull. U. S. Nat. Mus. xii, 20, 1878: type *Photogenis stigmaturus* Jor. (ἠρ, spring-time; γαλα, milk.)

males olivaceous, obscurely marked. Head $4\frac{1}{3}$; depth $4\frac{1}{3}$. D. 8; A. 8; scales 6–41–3; teeth 1, 4–4, 1, usually with entire edges. L. 5–6 inches. Cumberland River to Savannah River; abundant in the mountain streams. Known by its large size and the peculiar yellowish band across the caudal.

(*Hypsilepis galacturus* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 160: *Leuciscus kentuckiensis* Günther, vii, 251.)

249. C. eurystoma Jordan.

Body elongate, compressed, tapering toward the snout and the long caudal peduncle. Head moderate, larger than in *C. nivea*, rather pointed, wide on top; snout rather long. Muzzle large, quite oblique, the premaxillaries on the level of the pupil; upper jaw slightly the longer. Eye moderate, $3\frac{1}{2}$ in head. Scales moderate, rather closely imbricated, but less so than in *C. analostana*. Pectorals not reaching ventrals, the latter about to vent; vertical fins not especially elevated. Color olivaceous, the sides bright silvery, a round black spot, nearly as large as eye, at base of caudal; dorsal blotch rather faint; dorsal fin chiefly yellowish green, ferruginous above, the extreme tip milky white; caudal fin rusty, with milk-white tips; lower fins milk-white. Snout and front in males tuberculate; minute tubercles on sides of tail. Head $4\frac{1}{4}$; depth $4\frac{1}{3}$. D. 8; A. 8; scales 6–39–3; teeth 1, 4–4, 1, with narrow grinding surfaces, the edges of which are usually crenate. L. $3\frac{1}{2}$–4 inches. Chattahoochee River.

(*Photogenis eurystomus* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 356, exclusive of the smaller specimens mentioned, which are *Minnilus zonistius;* not *Codoma eurystoma* Jordan, Bull. U. S. Nat. Mus. xii, 42 = *Minnilus zonistius: Photogenis leucopus* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 41, 1878.)

250. C. nivea (Cope) J. & G.

Body regularly fusiform, the dorsal outline more arched than the ventral. Head conic. Muzzle obtuse, not projecting. Mouth nearly terminal, slightly oblique, maxillary reaching front of eye. Eye $3\frac{1}{3}$ in head. Coloration very pale, a narrow bluish band along the caudal peduncle, forming a faint spot at the root of the caudal. Dorsal fin in the males considerably elevated, largely dusky on its last rays, the rest of the fin creamy; the tips of the dorsal, the tips of the caudal, and the whole of the anal with milk-white pigment. Males with the snout and ante-dorsal region covered with small tubercles. Head $4\frac{1}{2}$; depth $5\frac{1}{2}$. D. 8; A. 8; scales 6–39–3; teeth 1, 4–4, 1, with narrow grinding surface. L. $2\frac{1}{2}$ inches. Basin of the Santee, North and South Carolina.

(*Hybopsis niveus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 460: *Photogenis niveus* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 20.)

hh. Teeth without distinct grinding surface.
j. Anal fin short, of 8 or 9 rays.
k. A conspicuous dark blotch on upper posterior rays of dorsal.
l. Adult males with the vertical fins chiefly red; a conspicuous black spot at base of caudal.

251. C. callistia Jordan.

Body rather stout and compressed, rather heavy forward, the dorsal outline considerably elevated. Head stout and rather blunt, its upper part flattish; the nuptial tubercles not numerous, arranged in a few distinct longitudinal rows, not scattered without order, as in related species. Mouth large, nearly horizontal, slightly overlapped by the heavy snout, the maxillary reaching nearly to the eye, the premaxillaries anteriorly entirely below the level of the orbit. Eye large, $3\frac{3}{5}$ in head. Scales large, not very closely imbricated, 16 in front of dorsal. Fins rather large, the height of the dorsal in males nearly one-fifth of length of body. Coloration dark and brilliant. Males with the back very dark steel-blue; sides a clear silvery violet; belly and lower fins satin-white. A heavy black blotch on posterior part of dorsal, extending downward and forming a horizontal bar at the base of the fin; the rest of the fin vermilion, except the milk-white tip. Caudal fin bright red, yellowish at base, milky at tip; a broad golden vertebral band and a reddish lateral streak; a large, distinct, round black spot at base of caudal. Females olivaceous, with less black; the fins dull reddish. Head $4\frac{1}{5}$; depth $4\frac{3}{5}$. D. 8; A. 8; scales 5–40–3; teeth 1, 4–4, 1. L. 4 inches. Alabama Basin.

(*Photogenis callistius* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 337: *Codoma callistia* Jordan, Bull. U. S. Nat. Mus. xii, 52.)

252. C. trichroistia Jor. & Gilb.

Body rather slender, compressed. Head slender and pointed. Eye moderate, $3\frac{2}{3}$ in head. Mouth quite large, very oblique, the maxillary reaching the anterior margin of the eye, the premaxillaries on the level of the middle of the pupil. Lateral line considerably decurved, usually with an abrupt angulation between pectorals and ventrals. Nineteen scales before the dorsal. Fins moderate; dorsal well behind ventrals. Nuptial tubercles sparse on the head. Caudal peduncle and sides as far forward as the ventrals tuberculate in spring males. Males bright steel-blue above; sides bright white; a large black spot at base of caudal, precisely as in *C. callistia;* dorsal fin with a broad, dusky, horizontal band at base, the membrane of the last rays jet-black, the tip milk-white, the rest of the fin of a bright, pale vermilion-red; caudal rosy, its tips white; anal and ventrals milky. Females duller, but the black markings distinct. Head $4\frac{1}{8}$; depth $4\frac{1}{4}$; scales 6–42–3; teeth 1, 4–4, 1.

L. 3½ inches. Alabama Basin; abundant in clear streams, with the preceding and the next.

(*Codoma trichroistia* Jordan & Gilbert, Bull. U. S. Nat. Mus. xii, 1878, 50.)

ll. Adult males without red.

m. A very conspicuous black spot at base of caudal.

253. C. stigmatura Jordan.—*Spotted-tail Minnow.*

Body elongate, fusiform, compressed. Head quite long, rounded above, the snout pointed. Mouth rather large, somewhat oblique, overlapped by the narrow upper jaw. Eye small, 4¼ in head; iris white. Maxillary reaching beyond nostrils; premaxillary on the level of lower edge of pupil. Scales large, closely imbricated, 20 in front of the dorsal. Fins low, the dorsal rather behind ventrals, its height less than one-fifth the length of the body. Color pale, clear olive; black dorsal spot not very distinct; fins with their tips charged with satin-white pigment, otherwise plain; a very distinct, large, oblong or quadrate jet-black spot at base of caudal, the color extending up on the rays. This spot is visible on all specimens, and is larger than in any other of our *Cyprinidæ;* its length about one-third that of the head. First ray of dorsal dark in front; males with an obsolete black spot on the middle of the sides in front of the dorsal, as is often seen in *Characinidæ*, the head, etc., tuberculate in spring. Head 4½; depth 4¾. D. 8; A. 8; scales 7–42–3; teeth 1, 4–4, 1. L. 4½ inches. Alabama and Mississippi; very abundant. The largest species of this section of the genus and one of the most graceful.

(*Photogenis stigmaturus* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 337: *Codoma stigmatura* Jordan, Bull. U. S. Nat. Mus. xii, 52: *Luxilus chicasavensis* Hay, Proc. U. S. Nat. Mus. 1880, 506.)

mm. No conspicuous black spot at base of caudal.

254. C. cærulea Jordan.

Body fusiform, somewhat elongate, moderately compressed. Head moderate. Snout rather pointed, overlapping the small, oblique mouth, maxillaries reaching nostrils, premaxillaries below level of pupil. Eye moderate, 3½ in head. Scales firm, 15 in front of dorsal. Lateral line decurved. Fins all high, the height of the dorsal nearly one-fifth the length of the fish; dorsal behind ventrals. Males with the snout thickly tuberculate. Color bright steel-blue; the sides and belly silvery white; a very distinct lateral band of a bright blue-green color, most distinct posteriorly, and forming a spot at the base of the caudal fin; dorsal blotch rather faint and diffuse; tips of dorsal, anal, and

caudal charged with satin-white pigment; the fins otherwise all of a clear, bright yellow. Females and young with the markings obscure, the blue lateral band usually evident. Head $4\frac{1}{3}$; depth $4\frac{3}{5}$. D. 8; A. 8; scales 6–38–3; teeth 1, 4–4, 1. L. 3 inches. Alabama Basin.

(*Photogenis cæruleus* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 338: *Codoma cærulea* Jordan, Bull. U. S. Nat. Mus. xii, 52, 1878.)

255. C. chloristia Jordan & Brayton.

Body short and deep, strongly compressed, the form elliptical, as in *C. pyrrhomelas*, but rather deeper. Head rather small and pointed. Mouth quite oblique, the maxillary not reaching the line of the orbit, the upper jaw projecting beyond the lower, premaxillary on the level of the pupil. Eye small, less than snout, 4 in head. Lateral line decurved. Fins moderate. Nuptial tubercles covering the whole body, except the space anterior to the ventrals and below the lateral line; those on the body much smaller than those on the head. Coloration dark steel-blue; a very distinct blue stripe along each side of caudal peduncle; back clear green; lower part of sides abruptly milk-white; black dorsal blotch large, the lower part of the fin with bright pale-green pigment, the tip milky; caudal dusky, its tips milky, its base pale; anal and ventrals milky, a faint dusky spot on last rays of anal; iris white. Females slenderer and less brightly colored; no caudal spot. Head 4; depth 4. D. 7; A. 8; scales 5–37–3; teeth 1, 4–4, 1. L. 3 inches. Santee Basin, South Carolina.

(*Codoma chloristia* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 21, 1878.)

kk. No dark blotch on upper posterior part of dorsal.

256. C. zonata (Agassiz) Jor. & Gilb.

Physiognomy of *Ceratichthys dissimilis*. Body elongate, not elevated. Head elongate. Mouth small, nearly horizontal, the maxillary reaching beyond line of orbit, the mandible somewhat projecting. Region in front of dorsal fin more or less bare of scales. Eye large, $3\frac{1}{2}$ in head. Dorsal beginning opposite ventrals, nearer snout than base of caudal. Olivaceous silvery below; a broad, silvery lateral band, with dark specks; sides of head with black specks; a dark vertebral band. Head 4; depth $4\frac{1}{3}$. D. 7; A. 8; scales 6–36–4; teeth 1, 4–4, 1. L. 3 inches. North Platte River (*Cope*); Osage River (*Agassiz*).

(*Alburnus zonatus* Putnam, Bull. Mus. Comp. Zoöl. i, 9, 1863: *Photogenis piptolepis* Cope, Hayden's Geol. Surv. Terr. Wyom. 1870, 438: *Leuciscus zonatus* Günther, vii, 253.)

jj. Anal fin long, of 10 or 11 rays; fins high.

257. C. xænura Jordan.

Body moderately elongate, subfusiform, heavy forwards. Head heavy, somewhat elongate, rounded above. Mouth large, oblique, the lower jaw included, maxillary reaching almost to orbit, premaxillary on level of upper part of pupil. Eye large, $3\frac{3}{4}$ in head. Fins all rather low, the height of the dorsal fin, even in the males, only two-thirds the length of head; caudal fin large. Color dark steel-blue; silvery below; a faint black spot at base of caudal; scales above dark-edged. Males with the fins mostly bright crimson; the dorsal largely black at its upper posterior part; dorsal, anal, and caudal fins with white pigment; belly and bases of the lower fins likewise pigmented; head and caudal peduncle tuberculate in spring. Head 4; depth $3\frac{3}{4}$. D. 8; A. 10; scales 6–39–3; teeth 1, 4–4, 1. L. 3 inches. Altamaha Basin, Georgia; locally abundant.

(*Minnilus xænurus* Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 79: *Codoma xænura* Jordan, Bull. U. S. Nat. Mus. xii, 52.)

258. C. pyrrhomelas (Cope) J. & G.

Body deep and compressed. Head stout, rather blunt. Mouth oblique, the jaws about equal, maxillary reaching front of orbit. Eye large, $3\frac{2}{3}$ in head. Pectorals barely reaching ventrals, the latter to anal; dorsal fin greatly elevated, its height in the male as great as length of head; caudal very broad and long, its peduncle stout and compressed; anal fin large and long. Coloration of the males dark steel-blue above; the scales darker edged; the belly abruptly milky white; head pale reddish; snout, tip of lower jaw, and iris scarlet; dorsal dusky at base, the usual large black blotch above, red in front, and broadly milk-white at tip; tips of the caudal milk-white, next to this a dusky crescent, a wide crescent of bright scarlet inside of the black, extending into the two lobes of the fin; base of caudal pale; anterior region and sides of caudal peduncle with rather large tubercles. Females duller. Head 4; depth $3\frac{3}{4}$. D. 8; A. 10; scales 6–35–3; teeth 1, 4–4, 1. L. $3\frac{1}{4}$ inches. Santee Basin; very abundant. The most ornate of our *Cyprinidæ*.

(*Photogenis pyrrhomelas* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 463: *Codoma pyrrhomelas* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 22, 1878.)

259. C. hypseloptera (Günther) J. & G.

Body short, much compressed, the back elevated. Head short, flattened above, the muzzle pointed. Mouth large, very oblique, the jaws

just equal. Eye large, 3 in head, about equal to snout and to interorbital space. Scales with the exposed surfaces very narrow. Lateral line much decurved; 16 large scales before dorsal. Dorsal fin inserted entirely behind the ventrals, greatly elevated, its longest ray a little longer than head; anal fin also very high and very long, extending almost to base of caudal; these fins somewhat lower in the females. Color silvery; the dorsal blotch conspicuous; a distinct black caudal spot, smaller than eye and deeper than long; sides with a silvery band which passes around the nose, below this a dusky band. Breeding colors unknown. Head $4\frac{1}{4}$; depth 4. D. 8; A. 11; scales 6–35–3; teeth 1, 4–4, 1. L. $2\frac{1}{2}$ inches. Southern Georgia and Alabama.

(*Alburnus formosus* Putnam, Bull. Mus. Comp. Zoöl. i, 9, 1863 (not *Moniana formosa* Grd.): *Leucisous hypselopterus* Günther, vii, 255: *Photogenis grandipinnis* Jordan, Bull. U. S. Nat. Mus. x, 62, 1877.)

85.—MINNILUS Rafinesque.

Shiners.

(*?? Notropis* Rafinesque, 1818; *Minnilus*, *Luxilus*, and *Plargyrus* Rafinesque; *Hypsilepis* Baird; *Alburnellus* and *Alburnops* Girard; *Lythrurus* and *Hydrophlox* Jordan.)

(Rafinesque, Ichth. Oh. 1820, 47: type *Minnilus dinemus* Raf.)

Body oblong or elongate, more or less compressed. Mouth normal, mostly terminal and oblique. No barbels. Teeth 2, 4–4, 2, sharp-edged or with a narrow grinding surface. Scales usually large, often closely imbricated. Lateral line complete, usually decurved. Dorsal fin inserted above, or more usually behind, the ventrals; anal fin short or somewhat elongate. Abdomen rounded. Coloration often brilliant, the males in spring usually with red fins and the head with small tubercles. A very large group of small fishes, especially characteristic of the fresh waters of the Eastern United States. Various attempts have been made to divide this group into natural genera, but the gradation from one type to another is very perfect. (English *minnow;* French *menuise;* from Latin *minus*, small.)

This group may be subdivided as follows:

§ Anal fin short, its rays 7–9 (sometimes 10 in *M. zonistius*).

* Scales large, 35–50 in the lateral line.

† Teeth with the grinding surface more or less developed.

‡ Species attaining a large size, with the scales along the flanks nearly twice as deep as long, and so closely imbricated that the exposed surfaces are very narrow; back elevated and convex in the adult; lower jaw included; dorsal fin over ventrals (LUXILUS Raf.). *cornutus, selene.*

‡‡ Species of moderate size, with the scales short and deep, but less closely imbricated than in the preceding; body elongate, not much elevated; mouth large, oblique, the lower jaw projecting; dorsal fin inserted behind ventrals ..... *coccogenis, zonistius.*

‡‡‡ Species of small size, with the scales not much deeper than long, less closely imbricated; body oblong or elongate, little elevated; mouth moderate, oblique or horizontal; dorsal fin inserted close behind ventrals; nuptial colors mostly brilliant (ALBURNOPS Grd.).

roseus, rubricroceus, lutipinnis, chlorocephalus, chiliticus, chalybæus, chrosomus, xænocephalus, plumbeolus, lacertosus, shumardi, blennius.

†† Teeth without evident grinding surface.

a. Teeth with the edges serrate; scales closely imbricated.....*cercostigma.*

aa. Teeth not serrate; scales loosely imbricated, scarcely higher than long.

b. Dorsal fin inserted directly over the ventrals; anal rays 7–9; eye very large; scales large ("EPISEMA" Cope & Jordan).

ariommus, scabriceps, jejunus, leuciodus.

bb. Dorsal inserted behind ventrals .....*altipinnis, amabilis, megalops.*

** Scales small, about 55 in the lateral line .....*bivittatus, timpanogensis.*

§§ Anal fin more or less elongate, its rays 10–14.

c. Scales comparatively small, more or less closely imbricated, and with the exposed edges deep, as in *Codoma* and *Luxilus;* scales in front of dorsal small; teeth with grinding surface more or less developed. (LYTHRURUS Jordan.)

d. A black spot at base of dorsal in front.

cyanocephalus, atripes, diplæmius, ardens, punctulatus.

dd. A black spot at the upper anterior part of dorsal .....*rubripinnis.*

ddd. No distinct black spot on the dorsal.

e. Body short and deep .....*bellus.*

ee. Body slender and elongate.....*matutinus, lirus.*

cc. Scales comparatively large, not higher than long, and not closely imbricated; scales in front of dorsal large; teeth without grinding surface. (MINNILUS.)

f. Anal fin long, with about 14 rays.....*oligaspis.*

ff. Anal fin moderate, its rays 10 or 11.

g. Scales above lateral line in about 9 series .....*umbratilis.*

gg. Scales above lateral line in 5–7 series.

h. Ventral fins reaching beyond middle of dorsal.

scepticus, photogenis, telescopus, stilbius, percobromus, rubellus, dinemus, rubrifrons, jemezanus.

hh. Ventral fins scarcely reaching beyond front of dorsal.

micropteryx.

§ Anal fin short, its rays 7–9 (rarely 10).

* Scales large, 35–50 in the lateral line.

† Teeth with the grinding surface more or less developed.

‡ Species attaining a large size, with the scales along the flanks nearly twice as deep as long, and so closely imbricated that the exposed surfaces are very narrow; back elevated and convex in the adult male; the lower jaw included; dorsal fin inserted directly opposite ventrals. (*Luxilus* Raf.*)

260. M. cornutus (Mitchill) J. & G.—*Shiner; Red-fin; Dace.*

Body elongate in the young, in the adult short, compressed, with the anterior dorsal region much swollen and gibbous. Head rather heavy, compressed, rounded between the eyes, the snout bluntish. Mouth moderate, nearly horizontal, the jaws nearly equal, the lower somewhat included. Eye moderate, 4–5 in head, maxillary scarcely

* Rafinesque, Ichth. Oh. 1820, 47: type *Luxilus chrysocephalus* Raf. = *Cyprinus cornutus* Mitch. (From Latin *lux*, light = "Shiner".) (= *Hypsilepis* Baird.)

reaching front of eye, the premaxillaries below the level of the eye. Scales always deeper than long on the flanks, becoming extremely so in the adult. Lateral line decurved. Dorsal moderate, inserted directly over the ventrals in the young, thrown somewhat backward in the adult by the growth of the postoccipital region. Pectorals barely or not reaching ventrals, the latter about to vent. Region in front of dorsal typically with about 23 scales. Coloration dark steel-blue above; the scales with dusky edges, the bases also dusky; a gilt line along the back and one along each side, these distinct only when the fish is in the water; belly and lower part of the sides silvery, or bright rosy in spring males; dorsal fin somewhat dusky; other fins plain; the lower fins all rosy in spring males; head dark above; a dark shade behind scapula; lower jaw and region in front of dorsal to the tip of the snout covered with small tubercles in spring males; female and young fishes are plain olivaceous above and silvery below. Head $4\frac{1}{4}$; depth $3\frac{1}{4}$, varying much with age. D. 8; A. 9; scales 6–41–3; teeth 2, 4–4, 2, with rather narrow grinding surface. L. 5–8 inches. Entire region east of the Rocky Mountains excepting the South Atlantic States and Texas; almost everywhere the most abundant fish in small streams. Its variations are great. The following forms are worth distinguishing by name.

Var. **gibbus** Cope.

Sixteen scales before the dorsal fin. Anterior dorsal region in the males extremely short and swollen; the base of the dorsal therefore very oblique. Michigan to Kentucky; common.

(*Hypsilepis cornutus gibbus* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 158.)

Var. **frontalis** Agassiz.

Fifteen to eighteen scales in front of dorsal. Head heavy. Body less gibbous than in the preceding. Great Lake Region, etc.

(*Leuciscus frontalis* and *gracilis* Agassiz, Lake Superior, 368, 370.)

Var. **cerasinus** Cope.

Sixteen scales before dorsal; scales 6–40–3. Head 4 in length. Eye large, $3\frac{1}{4}$ in head. Colors very brilliant, in high coloration entirely red. Roanoke River.

(*Hypsilepis cornutus cerasinus* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 159.)

Var. **cornutus.**

Above described. The scales 22–25 in front of dorsal fin. Everywhere abundant.

(*Cyprinus cornutus* Mitchill, Amer. Month. Mag. i, 324: *Hypsilepis cornutus* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 158: *Plargyrus typicus* and *bowmani* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 196: *Plargyrus argentatus* Girard, l. c. 212: *Leuciscus cornutus* Günther, vii, 249: *Luxilus chrysocephalus* Raf. Ichth. Oh. 1820, 47.)

Var. **cyaneus** Cope.

Scales of the dorsal and ventral regions very small, 31–40 in front of the dorsal fin. Scales 10–40–4. Coloration extremely dark; blue-black above; fins chiefly black. Lake Superior.

(*Hypsilepis cornutus cyaneus* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 160.)

261. M. selene Jordan.

Body elongate, compressed. Head short and stout, rounded above. Mouth terminal, oblique, the lower jaw included. Muzzle blunt and short. Eye very large, 3 in head, wider than snout and than interorbital space. Dorsal fin very high. Lateral line little decurved. Bright steel-blue above, with a very distinct silvery band overlying a plumbeous shade; a dark spot at base of caudal; a dark vertebral line; cheeks, belly, and iris white; fins plain, probably red in spring. Head $4\frac{1}{2}$; depth $4\frac{1}{2}$. Scales 4–40–3; teeth 2, 4–4, 2. Lake Superior.

(*Luxilus selene* Jordan, Bull. U. S. Nat. Mus. x, 60, 1877.)

‡‡ Species of moderate size, with the scales short and deep, but less closely imbricated than in the preceding; body elongate, not much elevated; mouth large, oblique, the lower jaw projecting; dorsal fin inserted behind ventrals.

262. M. coccogenis (Cope) Jordan.—*Red-cheeked Shiner.*

Body elongate, compressed, not at all elevated. Head straight and rather pointed. Mouth large, very oblique, the premaxillary nearly on a level with the pupil, lower jaw projecting beyond upper, maxillary reaching past front of eye. Eye very large, $3\frac{1}{2}$ in head. About 20 scales in front of the dorsal fin. Back olivaceous; the scales dark-edged; belly and sides silvery, rosy in spring males; a dusky scapular band; a scarlet bar like a brand down the line of the preopercle; muzzle and upper lip red; a red axillary spot; outer half of dorsal black, lower half yellowish; outer part of caudal dusky, base paler; a faint lateral streak and a dark vertebral line; lower fins white; snout swollen and tuberculate in spring males; females silvery, with only traces of red markings. Head 4; depth $4\frac{1}{4}$. Scales 7–42–3; teeth 2, 4–4, 2. L. 5 inches. Cumberland to Savannah Rivers; abundant in the mountain streams.

(*Hypsilepis coccogenis* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 160: *Leuciscus coccogenis* Günther, vii, 253.)

263. M. zonistius Jordan.

Body rather stout, compressed, the back somewhat elevated, the form that of a young *Minnilus cornutus*. Head heavy, broad and flattish above, the profile evenly descending. Mouth large, but smaller than in *coccogenis*, oblique, the jaws about equal, the upper lip opposite the

middle of the eye, the maxillary reaching the front of orbit. Eye very large, longer than snout, 3½ in head. Scales not very closely imbricated; 17 scales in front of dorsal. Lateral line strongly decurved. Fins moderate, pectorals scarcely reaching ventrals. Steel-blue above; sides with considerable coppery lustre; dorsal fin with a sharp jet-black horizontal bar about half way up, reddish in young fishes, the tips of the fin somewhat milky, the base pale; a round black spot nearly as large as the eye at the base of the caudal; anal fin plain; caudal fin dull ferruginous red, pale at base as in *M. coccogenis*, milky at tip; back and sides with gilt lines, as in *M. cornutus*, the former becoming dark after death; a faint red bar down the cheeks as in *M. coccogenis;* a dark humeral bar; males with the snout tuberculate; females plain, so much resembling *Cliola eurystoma*, from the same waters, that the two species have been confounded. Head 3⅘; depth 3⅔. Scales 7–40–3; teeth 2, 4–4, 2, with very narrow grinding surface on one or two of them. L. 4 inches. Chattahoochee River, the typical examples from Suwannee Creek.

(*Codoma eurystoma* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 42, 1878, excl. syn. (not *Photogenis eurystomus* Jordan): *Luxilus zonistius* Jordan, Proc. U. S. Nat. Mus. 1879, 239.)

‡‡‡ Species of small size, with the scales not much deeper than long, less closely imbricated; body oblong or elongate, little elevated; mouth moderate, oblique or horizontal; dorsal fin inserted close behind ventrals; nuptial colors commonly brilliant. (*Alburnops* Grd.*)

264. M. roseus Jordan.

Body short and stout, little compressed. Head rather short, thick, bluntly rounded. Mouth moderate, slightly oblique, the jaws about equal. Eye large, nearly 3 in head, about equal to muzzle, a little less than the broad interorbital space. Fifteen scales before dorsal fin; dorsal fin high, directly over ventrals. Olivaceous; scales dark-edged; a broad plumbeous lateral band; lips black; a dark caudal spot; a dark vertebral line; anal region dusted with dark points; cheeks and belly silvery; males with the dorsal, anal, caudal, and pectorals mostly rosy red; iris, top of head, and tip of snout red. Head 3⅞; depth 4½. Scales 5–38–5; teeth 2, 4–4, 2. L. 2½ inches. Notalbany River, Louisiana.

(*Luxilus roseus* Jordan, Bull. U. S. Nat. Mus. x, 61, 1877.)

265. M. rubricroceus (Cope) J. & G.—*Red Fall-fish.*

Body moderately elongate, somewhat compressed. Head comparatively long and rather pointed. Mouth rather large, oblique, the jaws about equal. Eye large, as long as snout, 3½ in head, premaxillary

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* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 194: type *Alburnops blennius* Grd. (*Alburnus; ωψ,* appearance.) (= *Hydrophlox* Jor.)

rather below pupil, maxillary reaching beyond front of orbit. Lateral line somewhat decurved. Nineteen scales in front of dorsal. Dorsal inserted somewhat behind ventrals. Females plain olivaceous. Males dark steel-blue, a dark lateral band of coaly punctulations, which is usually distinct on the anterior part of the body, and passes through the eye around the snout; fins all rich, clear red, the dorsal crimson, the caudal pink, the lower fins scarlet; head pale red, the lower jaw flushed as if bloody; eyes bluish or flushed with red; a lustrous streak along sides; silvery below. In high coloration the whole body is more or less red. Males with the head and antedorsal region dusted with fine white tubercles. Head 4; depth $4\frac{1}{2}$. D. 8; A. 9; scales 7–38–3; teeth 2, 4–4, 2, the edges of the grinding surface often serrate. L. $2\frac{1}{2}$ inches. Headwaters of the Tennessee and Savannah Rivers. A surpassingly beautiful little fish, abounding in rock-pools at the foot of cascades.

(*Hybopsis rubricroceus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 231: *Hydrophlox rubricroceus* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 32, 1878.)

266. M. lutipinnis Jordan & Brayton.

Body stout and rather strongly compressed, the dorsal region somewhat elevated, the outline of the back sloping each way from the dorsal fin. Head short and rather deep, broad and flattish above, the muzzle moderately rounded. Eye rather large, $3\frac{2}{3}$ in head. Mouth rather large, but smaller than in the preceding, quite oblique, the maxillary reaching to orbit. Mandible included. Eighteen scales in front of dorsal. In life clear olive, with very intense green dorsal and vertebral lines; an intense metallic blackish band along sides; below this the sides are bright silvery; the whole body in the males bright, clear red, the color of red berries; fins all bright golden yellow; tip of lower jaw black. Head $4\frac{1}{8}$; depth $4\frac{1}{4}$. D. 8; A. 8; scales 7–40–3; teeth 2, 4–4, 2. L. 3 inches. Oconee River, Georgia.

(*Hydrophlox lutipinnis* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 36, 1878.)

267. M. chlorocephalus (Cope) Jor. & Gilb.

Body stout, with deep caudal peduncle. Head broad, with descending muzzle. Mouth oblique, the maxillary reaching beyond line of orbit, premaxillary opposite lower margin of pupil. Eye large, 3 in head. Interorbital space greater than muzzle. Lateral line moderately decurved. Sixteen scales in front of dorsal. Color olivaceous, everywhere dusted with blackish specks, which form a lateral band, which terminates in a dusky spot at base of caudal; green vertebral and lat-

eral lines; top of head and upper portion of cheeks metallic green; males with the belly dark crimson, the whole body more or less flushed; snout and antedorsal region tuberculate; fins plain. Head 4; depth 5. D. 8; A. 8; scales 6–39–3; teeth 2, 4–4, 2 (1, 4–4, 1, according to Cope, but we find 2, 4–4, 2 in numerous specimens). L. 2½ inches. Santee Basin, in North and South Carolina.

(*Hybopsis chlorocephalus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 461.)

268. M. chiliticus (Cope) J. & G.

Aspect more clupeoid. Head broad behind. Occiput convex. Muzzle acuminate, greater than interorbital width. Eye large, 3 in head, longer than muzzle, maxillary extending beyond anterior rim of orbit, premaxillaries opposite middle of pupil. Lateral line strongly decurved. Dorsal fin small. Olivaceous; dorsal scales brown-edged; sides and below pure white; males with the lips vermilion; a vermilion band through dorsal and one through anal fin. Head 4; depth 5½. D. 8; A. 8; scales 7–36–2; teeth 2, 4–4, 2. L. 2 inches. Yadkin River, North Carolina. (*Cope.*)

(*Hybopsis chiliticus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 462.)

269. M. chalybæus (Cope) J. & G.

Body moderately elongate, with rather abruptly elevated back and slender caudal peduncle. Head flat above, rather narrow, muzzle rather pointed. Mouth oblique, the lower jaw rather the longer. Lateral line decurved. Eye large, 3 in head. Eighteen scales in front of dorsal. Brownish above; a broad, black, shining lateral band from muzzle to base of caudal; a light band above it on the muzzle; belly straw-colored, bright orange in spring males; fins plain. Head 3⅘. D. 8; A. 8; scales 6–35–3; teeth 2, 4–4, 2. L. 2 inches. Delaware River, probably the smallest of the genus. (*Cope.*)

(*Hybopsis chalybæus* Cope, Cypr. Penn. 1866, 383.)

270. M. chrosomus Jordan.

Form chubby, little compressed, the back somewhat elevated, caudal peduncle not much contracted. Head rather large, rounded above, the snout somewhat pointed. Mouth moderate, oblique, the upper jaw the longer. Eye 3¼ in head, as long as muzzle. Scales everywhere large, 16 before the dorsal fin. Lateral line little decurved. Clear hyaline green in life, with blue reflections; belly, etc., clear silvery; a scarlet bar across dorsal, anal, and base of caudal; a narrow scarlet band from upper edge of opercles straight to caudal; below this a silvery band; a row of black dots along the lateral line, forming a small, distinct spot at

base of caudal; top of head and vertebral line golden. Snout tuberculate in males. Head $4\frac{1}{3}$; depth 5. D. 8; A. 8; scales 5–37–3; teeth 2, 4–4, 2. L. $2\frac{1}{2}$ inches. Alabama Basin; very abundant in clear streams. A graceful little fish.

(*Hybopsis chrosomus* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 333: *Hydrophlox chrosomus* Jordan & Brayton, l. c. 49.)

271. M. xænocephalus Jordan.

Body rather short and deep, with thick caudal peduncle; back wide, not elevated. Head large, flattish and broad above, the snout rounded. Mouth large, oblique, the jaws nearly equal. Eye very large, $2\frac{3}{4}$ in head. Lateral line somewhat decurved. Thirteen scales in front of the dorsal. Dorsal fin slightly behind ventrals. Dark olivaceous above, the scales being extensively dark-edged; a dark band along the sides of the caudal peduncle, which vanishes in black points along the sides of the body, reappearing on the head and passing around the snout; a dusky blotch at base of caudal. Males without red markings, the snout swollen and tuberculate in the spring. Head $4\frac{1}{5}$; depth 5. D. 8; A. 7; scales 5–38–3; teeth 2, 4–4, 2. L. $2\frac{3}{4}$ inches. Georgia to Mississippi.

(*Hybopsis xænocephalus* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 334.)

272. M. plumbeolus (Cope) J. & G.

Body oblong, compressed, the back somewhat arched. Mouth oblique, the lower jaw slightly longer than the upper. Fins short. Eye large, $2\frac{3}{4}$ in head. Silvery, with bluish reflection; top of head dusky; a dark spot at base of caudal. Head $4\frac{1}{8}$; depth $4\frac{2}{3}$. D. 8; A. 9; scales 6–39–3; teeth 2, 4–4, 2. L. 3 inches. Saginaw River. (*Cope.*)

(*Alburnops plumbeolus* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 282.)

273. M. lacertosus (Cope) J. & G.

Body stout. Head broad and deep. Mouth wide, the lower jaw projecting. Eye large, $3\frac{1}{4}$ in head, equal to muzzle and to width of interorbital space. Maxillary not reaching the line of the orbit. Scales large, only 5 above the lateral line. Silvery; dorsal region dusky; no red. Head 4. Teeth 2, 4–4, 2. L. $4\frac{1}{2}$ inches. Headwaters of Tennessee River. (*Cope.*)

(*Hybopsis lacertosus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 232.)

274. M. shumardi (Grd.) Jor. & Gilb.

Body moderately elongate. Snout subconical, not strongly decurved. Mouth rather large, oblique, the lower jaw included, maxillary reaching front of eye, upper lip above the level of the lower border of eye. Dorsal over ventrals. Eye large, $3\frac{1}{4}$ in head. Olivaceous; sides silvery;

fins plain. Head $4\frac{1}{4}$; depth $4\frac{1}{2}$. D. 8; A. 8; scales 5–40?–3. L. $3\frac{1}{2}$ inches. Arkansas River. (*Girard.*)

(*Alburnops shumardi* and *illecebrosus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 194, and U. S. Pac. R. R. Surv. x, 261, 262.)

275. M. blennius (Grd.) J. & G.

Body moderately elongate. Head moderate, the snout short and strongly convex, so that the mouth is nearly horizontal, the upper lip being below the level of the eye, lower jaw shorter than upper, maxillary extending beyond front of eye. Dorsal directly over ventrals, nearer snout than caudal. Scales deeper than long. Lateral line decurved. Head $4\frac{1}{4}$; depth $4\frac{1}{2}$. D. 8; A. 7; scales 6–40?–3. L. $3\frac{1}{2}$ inches. Arkansas River. (*Girard.*)

(*Alburnops blennius* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 194, and U. S. Pac. R. R. Surv. x, 261.)

†† Teeth without evident grinding surface.

a. Teeth with the edges serrate; scales closely imbricated.

276. M. cercostigma (Cope) J. & G.

"Teeth 2, 4–4, 2, with sharp, serrate edges (without grinding surface). Dorsal fin inserted 2 scales behind that above insertion of the ventrals. Dorsal line compressed, elevated, rising regularly from end of muzzle. Cranium convex above. Muzzle narrowed in proportion, slightly overhanging mouth. Eye $4\frac{1}{3}$ in length of head, $1\frac{1}{2}$ in length of muzzle, and 2 in interorbital width. End of maxillary opposite posterior margin of nares. Ventral outline less curved than dorsal. Caudal peduncle rather stout. Isthmus narrow. Scales rather elevated, 8-39–3. Lateral line gently decurved over ventrals. Head $4\frac{1}{4}$ in length to origin of caudal, 1 scale less than depth at dorsal. The pectorals nearly reach the ventrals, and the latter attain the vent. Radii: D. 8; A. 8; the longest (anal) ray four-thirds its base and three-sevenths distance to longest fulcrum at origin of caudal. Total length $4\frac{1}{2}$ inches. Color bright olive above, without line or spot; below and sides, from fifth row of scales above, golden silvery; all the fins, except the pectorals, with white pigment at their bases, without markings; a large, round black spot at base of caudal." Pearl River, Mississippi. (*Cope.*) The number of teeth in the inner row as above described renders it necessary for us to refer this fish to the genus *Minnilus*. Its affinities, however, are evidently with *Cliola*, and the recorded dentition may be abnormal.

(*Cyprinella cercostigma* Cope, Proc. Acad. Nat Sci. Phila. 1867, 157.)

aa. Teeth not serrate; scales loosely imbricated, scarcely higher than long.

b. Dorsal fin inserted directly over the ventrals; anal rays 7–9; eye very large; scales large. ("*Episema*"* Cope & Jordan.)

* Name preoccupied.

277. M. ariommus (Cope) Jor.—*Big-eyed Shiner.*

Body stout, moderately elevated, somewhat compressed. Head heavy, broad above, the snout moderate, somewhat decurved. Mouth moderate, oblique, the jaws equal, the upper lip on the level of the pupil, the maxillary reaching the front of the eye. Eye very large, $2\frac{3}{5}$ in head, much longer than snout, larger than in any other of the American *Cyprinidæ*. Fins moderate, the dorsal almost directly opposite ventrals. Scales large, 15 in front of the dorsal. Lateral line much decurved. Olivaceous; scales above dark-edged; sides and below bright silvery; no red. Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. D. 8; A. 9; scales 6–39–2; teeth 2, 4–4, 2. L. 5 inches. Ohio Valley. A handsome species.

(*Photogenis ariommus* Cope, Cypr. Penn. 1866, 378: *Cliola ariomma* Jordan, Man. Vert. ed. 2, 298.)

278. M. scabriceps (Cope) Jor.

Body rather stout, little compressed, the back slightly elevated. Head rather short and broad, the muzzle bluntish, somewhat decurved. Mouth rather small, terminal, oblique, the maxillary reaching front of orbit. Lateral line not much decurved. Fins rather small. Eye large, 3 in head. Color plain olivaceous; scales dark-edged above; sides white, with a lateral band formed of dusky specks, this band running through the eye around the snout. Males tuberculate in spring. Smaller than *M. ariommus* and less silvery. Head 4; depth $4\frac{1}{4}$. D. 8; A. 8; scales 6–38–3; 2, 4–4, 2. Ohio Valley.

(*Photogenis scabriceps* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 166: *Cliola scabriceps* Jordan, Man. Vert. ed. 2, 298.)

279. M. jejunus (Forbes) Jor. & Gilb.

Body rather slender. Head flattish above, the snout blunt and rounded. Mouth rather large, oblique. Eye rather large, $3\frac{2}{3}$ in head, equal to snout, less than interorbital space. Dorsal over ventrals. Sixteen scales before dorsal. Color pale, with a broad silvery lateral band overlying a plumbeous shade; dorsal sometimes punctulate. Head 4; depth $4\frac{2}{3}$. D. 8; A. 7; scales 5–37–3; teeth 2, 4–4, 1. L. 3 inches. Illinois River.

(*Episema jejuna* Forbes, Bull. Ills. Lab. Nat. Hist. ii, 60, 1878.)

280. M. leuciodus (Cope) Jor.

Body rather slender. Muzzle rounded in profile. Mouth oblique, the mandible not projecting. Lateral line nearly straight. Twelve rows of scales in front of the dorsal fin. Olivaceous; scales above dark-edged; sides silvery, with a purple band; a black spot at base of

caudal; muzzle and base of dorsal red in the males. Head $4\frac{1}{2}$. D. 8; A. 8; scales 5–39–3. L. 3 inches. Holston River. (*Cope.*)

(*Photogenis leuciodus* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 165.)

bb. Dorsal inserted behind ventrals.

281. M. altipinnis (Cope) Jor.

Body rather short and deep. Head short, compressed. Eye very large, longer than snout, $2\frac{3}{4}$ in head. Ventrals extending to beyond last rays of dorsal, reaching anal. Dorsal elevated, its height equal to half its distance from the snout. White; a lateral silvery band, strongly punctate with black; a black band across eye and snout. Head $4\frac{1}{3}$; depth 5. D. 8; A. 9; scales 5–36–2. L. $2\frac{1}{4}$ inches. Yadkin River, North Carolina. (*Cope.*)

(*Alburnellus altipinnis* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 464.)

282. M. amabilis (Grd.) Jor.

Body elliptical, rather deep. Head short and rather deep, with large eye, which is considerably longer than snout, 3 in head. Mouth terminal, oblique, the premaxillary opposite middle of pupil, the maxillary barely reaching the front of eye. Snout moderately pointed. Lateral line decurved. Fins moderate. Dorsal somewhat behind ventrals. Color olivaceous; sides silvery; a dusky blotch at base of caudal. Head $3\frac{4}{5}$; depth $4\frac{1}{3}$. D. 8; A. 9 or 10; scales 5–38?–3. L. $2\frac{1}{2}$ inches. Rio Leona, a tributary of Rio Nueces, Texas. (*Girard.*)

(*Alburnus amabilis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 193: *Alburnellus amabilis* Girard, U. S. Mex. Bound. Surv. Ichth. 51.)

283. M. megalops (Grd.) Jor.

Very similar, but represented as having the head shorter, deeper, and more obtuse, the premaxillary below the level of the pupil, the maxillary extending to beyond the front of eye. Olivaceous; sides silvery; no black caudal spot. Head $4\frac{1}{4}$; depth $4\frac{1}{4}$. D. 8; A. 9; scales probably as in the preceding. L. $2\frac{1}{2}$ inches. Rivers of Texas. (*Girard.*)

(*Alburnus megalops* and *socius* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 193: *Alburnellus megalops* and *socius* Girard, U. S. Mex. Bound. Surv. Ichth. 52.)

** Scales small, about 55 in the lateral line.

284. M. bivittatus (Cope) J. & G.

Body stout, the dorsal region arched. Muzzle narrow, not prominent, very obtusely descending. Mouth horizontal, the maxillary reaching the front of the orbit. Eye 4 in head, narrower than the flat interorbital space. Dorsal inserted slightly behind ventrals; pectorals

reaching only half way to ventrals. Color silvery; the scales punctate with blackish; a dark band from the shoulders to the base of caudal; another from the end of the muzzle, across operculum, to base of anal. Head $4\frac{2}{3}$; depth 4. D. 8; A. 7; scales 12–53–11; teeth 2, 4–4, 2. L. 3 inches. Warm Springs, Utah. (*Cope.*)

(*Hybopsis bivittatus* Cope, Hayden's Geol. Surv. Terr. for 1871, 1872, 474.)

285. M. timpanogensis (Cope) J. & G.

Body stout, rather compressed. Head heavy. Mouth oblique. Eye longer than muzzle, $3\frac{1}{3}$ in head. Dorsal fin slightly in front of ventrals; pectorals not reaching to ventrals, the latter reaching vent. Lateral line more or less incomplete (in the typical examples, which are all young; it is probably complete in the adult). Color brownish; the scales finely dusted with black points; a plumbeous lateral streak; cheeks silvery; fins dusky. Head $3\frac{2}{3}$; depth 4; scales 13–52–6; teeth 2, 4–4, 2. L. 2 inches. Streams of Utah. (*Cope.*) This species and the preceding are perhaps young *Squalii.*

(*Hybopsis timpanogensis* Cope, Proc. Amer. Phil. Soc. Phila. 1874, 134: *Hybopsis timpanogensis* Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. 654.)

c. Scales comparatively small, more or less closely imbricated, and with the exposed edges deep (as in *Codoma* and *Luxilus*); scales in front of dorsal small; teeth with the grinding surface more or less developed. (*Lythrurus* Jordan.*)

d. A black spot at base of dorsal in front.

286. M. cyanocephalus (Copeland) Hay.—*Hoy's Red-fish.*

Body short, stout, chubby, moderately compressed. Dorsal outline elevated, the axis of the body being half nearer the ventral outline than the dorsal. Caudal peduncle short, not contracted, the form resembling that of *Pimephales.* Head very short, deep, its greatest depth three-fourths its length. Snout blunt, shorter than eye. Mouth large, very oblique, lower jaw projecting, maxillary reaching to border of eye. Eye large, $3\frac{1}{3}$ in head, not so wide as the interorbital space. Fins large. Dorsal well behind ventrals, its longest ray about as long as head; pectorals not reaching ventrals, the latter to anal. Scales small, much crowded anteriorly. Lateral line strongly decurved. Dorsal scales small; thoracic region mostly naked. Coloration dark bluish above; sides not silvery. Males in spring profusely covered with small tubercles; the sides and fins clear, bright red; the back, and especially the top of the head, of a clear glaucous blue. Dorsal fin in both sexes with a large black spot at the base of its anterior rays, this spot about as

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*Jordan, Man. Vert. 1876, 272: type *Semotilus diplemius* Raf. (λύθρον, blood; οὐρά, tail.)

large as the eye; dorsal, anal, and ventrals blackish at tip. Head $4\frac{1}{8}$; depth 4. D. 8; A. 12; scales 9–46–4; teeth 2, 4–4, 2. L. $2\frac{1}{3}$ inches. Rivers of Southern Wisconsin, etc.

(*Lythrurus cyanocephalus* Copeland, Proc. Acad. Nat. Sci. Phila. 1877, 70.)

287. M. atripes (Jordan) Hay.

Body moderately elongate, very strongly compressed and elevated. Head comparatively pointed. Mouth rather large, quite oblique, the maxillary reaching to the front of eye; lower jaw projecting. Eye small, shorter than muzzle, 4 in head. Scales closely imbricated, crowded anteriorly. Lateral line strongly decurved. Dorsal fin beginning midway between ventrals and anal, high anteriorly; pectorals not quite reaching ventrals; the latter to vent. Coloration of body dark bluish, without traces of vertical bars; sides not silvery, the scales dusted with dark punctulations; dorsal with the usual black spot at base in front, smaller than in the other species; a black bar crosses its upper part; anal colored like the dorsal, the markings paler; ventral fins dusky. Males profusely tuberculate, and doubtless red in spring. Head $4\frac{1}{3}$; depth 4. D. 7; A. 11; scales 9–52–5; teeth 2, 4–4, 2. L. 3 inches. Southern Illinois. This species, and possibly the preceding also, may be local varieties of *M. diplemius*.

(*Lythrurus atripes* Jordan, Bull. Ills. Lab. Nat. Hist. ii, 59, 1878.)

288. M. diplæmius (Raf.) Hay.—*Red-fin.*

Body elongate, compressed, little elevated, the caudal peduncle notably long. Head long, conic, rather pointed. Mouth large, moderately oblique, the premaxillary on the level of the pupil, the maxillary extending to opposite the eye, lower jaw somewhat projecting. Eye moderate, about equal to muzzle, $3\frac{1}{2}$ in head. Scales closely imbricated, crowded anteriorly, the antedorsal scales about 30. Dorsal fin high, inserted about midway between ventrals and anal; pectorals not reaching ventrals, the latter to vent; caudal fin long. Coloration dark steel-blue above; pale or silvery below; the males often showing traces of 8–10 obscure cross-bars; a conspicuous spot at base of dorsal in front; the fins otherwise all plain. Males with the anterior dorsal region and the head profusely covered with small whitish tubercles, the belly and lower fins being of a bright brick-red in the spring. Females very pale olive, sometimes almost colorless. Head $4\frac{1}{4}$; depth $4\frac{1}{4}$. D. 7; A. 11; scales 9–47–3; teeth 2, 4–4, 2. L. $3\frac{1}{2}$ inches. Ohio and Upper Mississippi Valley and lake region; generally abundant in small, clear streams.

(*Semotilus diplemius* Raf. Ichth. Oh.: *Hypsilepis diplæmia* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 162; Jordan, Man. Vert. 295. *Leuciscus diplæmius* of Kirtland and of Günther is *Luxilus cornutus*.)

289. M. ardens (Cope) Hay.—*Southern Red-fin.*

Body elongate, little compressed and not at all elevated. Head long, conic, and pointed. Mouth large, oblique, the lower jaw scarcely longer, the maxillary reaching to opposite the eye. Eye rather large, $3\frac{1}{2}$ in head. Scales moderate, silvery, not closely imbricated. Lateral line decurved. Dorsal fin as in the other species; pectorals falling considerably short of ventrals. Coloration olivaceous; the scales dark-edged above; the sides with a brilliant silvery band; dorsal with a rather small black spot at base in front. Males in spring tuberculate, the entire body and fins brilliant red; crimson in spring, becoming more scarlet later. Young males variously purplish or pinkish. Head $4\frac{1}{3}$; depth $4\frac{1}{3}$. Scales 9–50–3; teeth 2, 4–4, 2. L. $2\frac{1}{2}$ inches. Cumberland, Upper Tennessee, and Roanoke Rivers. A beautiful inhabitant of the clear mountain streams.

(*Hypsilepis ardens* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 163: *Leuciscus ardens* Günther, vii, 257.)

290. M. punctulatus Hay.

Body short, deep, compressed. Back elevated in front of dorsal. Head short and deep. Profile straight or slightly concave. Mouth large, quite oblique, maxillary reaching anterior rim of orbit. Eye moderate, $3\frac{1}{2}$ in head. Scales small, 25 in front of dorsal. Lateral line much decurved. Dorsal beginning midway between muzzle and base of caudal. Caudal peduncle compressed. Straw-color; silvery on sides and below; scales above dark-edged; a dark dorsal line; a dark band on caudal peduncle; a small black spot at base of dorsal. Head $4\frac{2}{3}$; depth $4\frac{1}{3}$. D. 8; A. 10 or 11; scales 11–49–3; teeth 2, 4–4, 2, with grinding surface. L. 2 inches. Tuscumbia River, Mississippi. (*Hay.*)

(Hay, Proc. U. S. Nat. Mus. 1880, 508.)

†† A black spot on the upper anterior part of the dorsal.

291. M. rubripinnis Hay.

Body long and slender, much compressed. Mouth large, oblique, the lower jaw somewhat projecting, the maxillary reaching the vertical from the front of the eye. Eye large, $3\frac{1}{2}$ in head, slightly longer than snout. Scales small, especially along the back, somewhat higher than long, but not so closely imbricated as in *M. bellus*. Lateral line much decurved. Dorsal far back, midway between pupil and base of caudal and considerably posterior to ventrals; pectorals not reaching ventrals, the latter to vent. Dark; scales above all with black points; a plumbeous lateral band, ending in a vague caudal spot; a narrow dorsal band; a black spot on the upper anterior portion of the dorsal and also on the anal,

each surrounded by a diffuse blotch; tip of ventrals and edge of pectorals dark; vertical fins red. Head $4\frac{1}{2}$; depth 4. D. 8; A. 11; scales 8–45–3. L. $2\frac{1}{4}$ inches. Chickasawha River, Mississippi.

(Hay, Proc. U. S. Nat. Mus. 1880, 509.)

††† No distinct black spot on the dorsal.

a. Body short and deep.

292. M. bellus Hay.

Body short, deep, considerably compressed. Dorsal region elevated. Head short. Muzzle short, rather pointed, the profile somewhat concave. Mouth large, oblique, the maxillary extending to opposite the front of orbit, the lower jaw projecting. Lateral line much decurved. Scales crowded forwards, 25 in front of dorsal. Dorsal midway between snout and caudal, behind ventrals; pectorals not reaching ventrals, the latter to vent. Caudal peduncle slender. Dusky above, with a narrow dark dorsal line; sides silvery, with plumbeous streak; no spot at base of dorsal; fins mostly black-tipped; belly flame-color in life; fins orange at base. Head $4\frac{1}{4}$; depth $3\frac{3}{4}$. D. 8; A. 10 or 11; scales 7–41–3; teeth 2, 4–4, 2, "sharp-edged, but with a masticatory surface". L. $2\frac{1}{2}$ inches. Tombigbee River, Mississippi. (*Hay.*)

(Hay, Proc. U. S. Nat. Mus. 1880, 510.)

aa. Body slender and elongate.

293. M. matutinus (Cope) Jor.

Body slender. Orbit large, $3\frac{1}{2}$ in head, scarcely larger than length of muzzle, equal to interorbital width. Olivaceous above; the scales brown-shaded; a plumbeous lateral band; sides and below bright silvery; a dark spot at base of caudal. Males with the muzzle and chin red. Head $4\frac{1}{4}$; depth 6. D. 8; A. 11; scales 7–44–3; teeth without grinding surface. L. $2\frac{1}{2}$ inches. Neuse River. (*Cope.*)

(*Alburnellus matutinus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 465.)

294. M. lirus Jordan.

Body slim, compressed. Head small, short, moderately deep, flattish above. Mouth rather large, very oblique, the lower jaw slightly projecting. Eye very large, longer than snout, 3 in head, the maxillary about reaching its front. Scales small, loosely imbricated, their outlines extremely indistinct. Fins moderate. Coloration very pale translucent green; scales of back finely punctate; sides with a very distinct metallic blue band formed of dark punctulations, this band passing through the eye and snout and forming a most characteristic color-marking; a streak of black dots along the bases of dorsal and anal,

that on the dorsal suggesting the peculiar spot of the other *Lythruri;* tip of snout black; fins pale olivaceous, red in the males. Males in spring with the head and antedorsal region profusely tuberculated. Head $4\frac{1}{3}$; depth $5\frac{1}{4}$. D. 8; A. 10; scales 8–45–4; teeth 2, 4–4, 2, with very narrow or obsolete grinding surface. L. $2\frac{1}{2}$ inches. Tennessee and Alabama Rivers.

(*Nototropis lirus* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 342.)

** Scales comparatively large, not higher than long, and not closely imbricated; scales in front of dorsal large; teeth without grinding surface. (*Minnilus.**)

b. Anal fin long, its rays 14.

295. M. oligaspis (Cope) Jor.

"Under jaw projecting a little beyond upper, maxillary extending to opposite posterior nostril. Head conic in profile, with muzzle compressed, one-fifth of length to notch of caudal. Eye $3\frac{1}{5}$ in length of head. Operculum higher than long. Fins short (except anal); ventrals anterior to dorsal. D. I, 8; A. I, 14. Scales rather large, 5–41–2; lateral line with a long, gentle anterior deflection. Above reddish; sides of head and broad lateral band silvery; body medially yellowish." (*Cope.*) L. 2 inches. Kansas. Perhaps a member of some other genus.

(*Alburnus oligaspis* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 282: *Abramis? oligaspis* Günther, vii, 309.)

bb. Anal fin moderate, its rays 10 or 11.

c. Scales above lateral line in about 9 series.

296. M. umbratilis (Grd.) Jor.

A short, deep species, like a *Notemigonus.* Maxillary reaching orbit. Lateral line deflexed. Olivaceous; sides silvery. Head 4; depth 4. D. 8; A. 11; scales 9–?–4. L. 3 inches. Arkansas River. (*Girard.*)

(*Alburnus umbratilis* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 193: *Alburnellus umbratilis* Grd. U. S. Pac. R. R. Surv. x, 260.)

cc. Scales above lateral line in 5–7 series.

d. Ventral fins reaching beyond middle of dorsal.

297. M. scepticus Jordan & Gilb. sp. nov.

Body short and deep, compressed and somewhat elevated. Head rather large, deep, bluntish, resembling the head of *Minnilus cornutus.* Mouth moderate, terminal, oblique, lower jaw slightly included, upper lip opposite middle of eye, the maxillary extending to front of orbit. Eye very large, longer than snout, 3 in head; interorbital space broad, flattish. Scales large. Lateral line much decurved. Fins moderate;

* *Alburnellus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 193.

the dorsal well behind ventrals, the tips of the ventrals extending to the last dorsal ray. Caudal peduncle moderate. Coloration very pale; sides with a bright silvery band; scales with very little dark edging; a dark line at base of dorsal; males in spring with the snout profusely tuberculate. Head $3\frac{3}{4}$; depth 4. D. 8; A. 10; scales 6–38–3; teeth 2, 4–4, 1. L. 3 inches. Saluda River, South Carolina.

(*Notropis photogenis* ("pale variety") Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 22, 1878.)

298. M. photogenis (Cope) Jor.

Body more slender, compressed. Head moderate. Mouth quite oblique, lower jaw scarcely projecting; maxillary about reaching orbit. Back broad. Dorsal fin inserted behind middle of body, a little behind ventrals. Lateral line decurved. Eye large, $3\frac{1}{3}$ in head. Color olivaceous, with brown vertebral and dorsal lines; sides and below bright silvery; cheeks silvery. Head $4\frac{1}{4}$; depth $5\frac{1}{2}$. D. 8; A. 10; scales 6–40–3. L. 3 inches. Alleghany region, Pennsylvania, to North Carolina, on both sides of the mountains; abundant and variable. Var. *engraulinus* Cope is slenderer, the depth 6 in length, the head $3\frac{2}{3}$.

(*Squalius photogenis* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 280: *Photogenis leucops* Cope, Proc. Acad. Nat. Sci Phila. 1867, 164: *Leuciscus photogenis* Günther, vii, 252.)

299. M. telescopus (Cope) Jor. & Gilb.

Very near the preceding, but with the dorsal fin inserted about midway between snout and base of caudal, not much behind ventrals. Eye longer than muzzle, $2\frac{3}{4}$ in head. Mouth very oblique, mandible not projecting. Color pale greenish; the scales extensively dark-edged above. Head $4\frac{1}{4}$; depth 5. D. 8; A. 10; scales 5–38–3. L. $3\frac{1}{2}$ inches. Tennessee River.

(*Photogenis telescopus* Cope, Proc. Acad. Nat. Sci. Phila. 1867, 165: *Leuciscus telescopus* Günther, vii, 252.)

300. M. stilbius Jordan.

Body rather slender. Head rather long, somewhat pointed. Mouth large, oblique, the maxillary reaching to the eye. Eye very large, greater than snout and than interorbital width, 3 in head. Fins rather high; the ventrals reaching to opposite the last rays of the dorsal. Color pale silvery green; sides with a broad silvery band, on which are many dark punctulations; these are numerous just behind the shoulder-girdle and at the base of the caudal, where they form an evident spot; cheeks pure silvery; lips dusky. Head $4\frac{1}{5}$; depth 5. D. 8; A. 10; scales 5–37–2; teeth 2, 4–4, 1. L. 3 inches. Alabama River.

(*Nototropis stilbius* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 343.)

301. M. percobromus Cope.

Body moderately elongate. Head rather long, the muzzle acuminate. Mouth oblique, the jaws equal, the maxillary extending behind front of orbit. Eye moderate, $3\frac{1}{2}$ in length, as long as snout. Dorsal beginning slightly behind ventrals. Seventeen scales in front of dorsal. Color pale, with lateral silvery band; dorsal scales and scales at base of caudal with dark punctulations. Head $3\frac{3}{4}$; depth $4\frac{3}{4}$. D. 8; A. 11; scales 7–37–3; teeth 2, 4–4, 2. L. 2 inches. Saint Joseph, Mo. (*Cope.*)

(*Alburnellus percobromus* Cope, Hayden's Geol. Surv. Wyom. 1870, 440.)

302. M. rubellus (Ag.) Jor.—*Rosy Minnow.*

Body long and slender, compressed, the back not elevated. Head blunt, conic, proportionately shorter than in the other species. Mouth moderate, very oblique, upper lip on the level of the upper part of the pupil, maxillary about reaching to the front of the eye. Eye large, rather longer than snout, $3\frac{1}{4}$ in head. Fins low; the dorsal well behind the ventrals, the tips of the ventrals extending to beyond the middle of the dorsal. Lateral line decurved. Color translucent green above; sides bright silvery; scales above faintly punctate, but not enough to render them dark-edged, nor to form blotches along the sides; a faint dark vertebral line; males in spring with the snout rosy. Head $4\frac{2}{3}$; depth $5\frac{1}{2}$. D. 8; A. 11; scales 5–38–3; teeth 2, 4-4, 2. L. 5 inches. Great Lake region and Ohio and Mississippi Valleys; abundant in lakes and river channels. Variable. The largest and handsomest species of this genus.

(*??Notropis atherinoides* Raf. Amer. Month. Mag. & Crit. Rev. 1818, 204 (very doubtful, perhaps a *Notemigonus*): *Alburnus rubellus* Agassiz, Lake Superior, 1850, 364: *Alburnus nitidus* Kirtland, Cleveland Ann. Sci. 1854, 44: *Alburnellus jaculus* and *arge* Cope, Cypr. Penn. 1866, 387: *Leuciscus rubellus* and *copei* Günther, vii, 254, 255.)

303. M. dinemus Raf.—*Emerald Minnow.*

Very similar to the preceding, but smaller and more compressed, with shorter snout, smaller eye, narrower and more convex interorbital space, which is not wider than eye, and shorter ventrals, which scarcely reach the middle of the dorsal. Colors very pale; lips dusky. Head $4\frac{2}{3}$; depth $5\frac{1}{2}$ (to $4\frac{1}{2}$). D. 8; A. 10; scales 6–38–3; teeth 2, 4–4, 2. L. $3\frac{1}{2}$ inches. Ohio Valley. Described from specimens taken at the Falls of the Ohio.

(*Minnilus dinemus* Raf. Ichth. Oh. 45: *Alburnus dilectus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 193: *Alburnellus dilectus* Grd. U. S. Pac. R. R. Surv. x, 259: *Notropis dilectus* and *dinemus* Jordan, Man. Vert. 296, 297.)

304. M. rubrifrons (Cope) Jordan.—*Rosy-faced Minnow.*

Body moderately elongate, the back scarcely elevated, the caudal peduncle somewhat contracted. Head longer than in the other species,

conic and rather pointed. Mouth rather large, very oblique, upper lip above the line of the middle of the pupil, the maxillary reaching to opposite the eye. Eye moderate, anterior, 4 in head. Olivaceous above; scales with darker edges; sides silvery; a dark vertebral line; males with the snout tuberculate in spring, the forehead, opercular region, and base of dorsal being then flushed with red. Head 4; depth $4\frac{3}{4}$. D. 8; A. 10; scales 5–39–3. Teeth 2, 4–4, 2, little hooked, one of them sometimes showing a sort of grinding face. L. $2\frac{3}{4}$ inches. Ohio Valley. An elegant species. Much smaller than *rubellus*, with larger head and deeper body.

(*Alburnus rubrifrons* Cope, Proc. Acad. Nat. Sci. Phila. 1865, 85: *Alburnellus rubrifrons* Cope, Cypr. Penn. 1866, 388: *Leuciscus rubrifrons* Günther, vii, 225: *Notropis rubrifrons* Jordan, 296.)

305. M. jemezanus (Cope) Jor.

Body slender, with long caudal peduncle. Head large, the muzzle long-acuminate. Mouth large, oblique, the upper lip below the line of the pupil, the maxillary extending beyond front of orbit. Eye moderate, $3\frac{2}{3}$ in head. Dorsal rather posterior, the tips of the ventrals extending beyond its last ray. Olivaceous; a broad silvery band, with plumbeous superior margin; a dusky vertebral band. Head $4\frac{1}{5}$; depth 6. D. 8; A. 10; scales 5–34–2; teeth 2, 4–4, 1. L. 3 inches. San Ildefonso (Rio Grande), New Mexico. (*Cope.*)

(*Alburnellus jemezanus* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 650, 1876.)

ccc. Ventral fins short, scarcely reaching beyond front of dorsal.

306. M. micropteryx (Cope) Jor.

Body slender, compressed. Head moderate, rather pointed. Mouth large, oblique, the upper lip on the level of the pupil, the maxillary reaching to opposite the front of the orbit. Eye small, about as long as muzzle, $3\frac{1}{2}$ in head. Scales large. Lateral line decurved. Fins all quite small, the dorsal farther back than in any of the preceding species, so that the short ventrals do not reach much beyond its anterior rays. Color olivaceous; sides bright silvery; dorsal scales conspicuously dark-edged; a dusky blotch at base of caudal, underlying the silvery lustre. Head $4\frac{1}{2}$; depth $5\frac{1}{2}$. D. 8; A. 10; scales 6–39–2. L. $2\frac{3}{4}$ inches. Headwaters of Cumberland and Tennessee Rivers.

(*Alburnellus micropteryx* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 233.)

86.—PROTOPORUS Cope.

(Cope, Hayden's Geol. Surv. Terr. 1871, 473: type *Protoporus domninus* Cope.)

Body rather stout. Mouth normal. No barbel. Teeth 2, 4–4, 1, hooked, without masticatory surface. Scales small, in 50–60 transverse

series. Lateral line short or nearly obsolete. (Dorsal fin not described.) Anal basis short. Small fishes, differing from *Minnilus* in the incomplete condition of the lateral line; possibly merely the young of some *Squalius*. ($\pi\rho\tilde{\omega}\tau o\varsigma$, before; $\pi\acute{o}\rho o\varsigma$, pore.)

307. P. dominuus Cope.

Body rather stout, front convex. Muzzle obtuse. Mouth horizontal, end of maxillary not quite reaching orbit. Eye 4 in head. Lateral line not developed as far as the ventral fins. Grayish; a broad dark lateral band, spotted with darker; back and top of head dark. Head $4\frac{1}{3}$; depth 5. D. 8; A. 7; scales 9–56–6; teeth 2, 4–4, 1. L. 2 inches. Fort Hall, Idaho. (*Cope.*)

(Cope, Hayden's Geol. Surv. Mont. 1871, 473, 1872.)

87.—ERICYMBA Cope.

(Cope, Proc. Acad. Nat. Sci. Phila. 1865, 88: type *Ericymba buccata* Cope.)

Body rather elongate, little compressed. Muzzle broad. Interopercle, suborbital, and dentary bones crossed by conspicuous, externally visible, mucous channels. Lips thin. No barbel. Teeth 1, 4–4, 0, without grinding surface, hooked, the edges entire. Scales rather large. Lateral line continuous. Dorsal fin above ventrals. Anal basis short. Silvery fishes of rather small size, known at once from all other minnows by the cavernous bones of the lower part of head. ($\dot{\varepsilon}\rho\acute{\iota}$, an intensive particle; $\kappa\upsilon\acute{\upsilon}\beta\eta$, a cavity; in allusion to the development of the mucous channels.)

308. E. buccata Cope.

Body fusiform, rather elongate, little compressed, the back not elevated. Head rather long, somewhat depressed above, with broad and prominent muzzle. Mouth rather small, horizontal, subinferior, the lower jaw considerably shorter than upper, upper lip below level of pupil, maxillary not reaching to eye, dentary bones dilated, the mucous channels conspicuous. Suborbital very broad, silvery, with an elevated longitudinal ridge and conspicuous cross-lines; opercle small. Eye large, 4 in head. Fins small, dorsal over ventrals. Scales moderate. Lateral line nearly straight. Breast scaleless; 15 large scales before dorsal. Color olivaceous, rather pale; sides bright silvery, with bluish reflections; a dark dorsal streak, conspicuous posteriorly; fins plain; males without tubercles or bright colors. Head $3\frac{5}{6}$; depth 5. D. 8; A. 8; scales 5–33–3; teeth 1, 4–4, 0. L. 5 inches. Ohio Valley to Mississippi (*Hay*); locally very abundant. One of our most remarkable species of *Cyprinidæ*.

(Cope, Proc. Acad. Nat. Sci. Phila. 1865, 87, and Cypr. Penn. 361; Günther, vii, 185.)

88.—PHENACOBIUS Cope.

(*Sarcidium* Cope.)

(Cope, Proc. Acad. Nat. Sci. Phila. 1867, 96: type *Phenacobius teretulus* Cope.)

Body elongate, little compressed. Mouth inferior, the lower lip thin mesially, but enlarged into a fleshy lobe on each side toward the angle of the mouth, thus presenting a superficial resemblance to that of *Exoglossum*, with which the genius has probably real affinities; upper lip with a callous covering within; dentary bones distinct, except at symphysis. No barbel. Upper jaw protractile. Teeth 4–4, hooked, without grinding surface. Scales rather small. Lateral line complete. Dorsal fin in front of ventrals; anal basis short. Isthmus extremely wide. Intestines short; peritoneum white. Small species, with the aspect of young suckers. (φέναξ, deceptive; βίος, life; the appearance of the fish suggesting an herbivorous species with long intestines, which it really is not.)

* Scales moderate, 43–50 in the course of the lateral line.

309. P. teretulus Cope.

Body slender, little compressed, the back not elevated, the caudal peduncle stout. Head stout, the muzzle elongate, obtusely decurved, heavy. Mouth small, inferior, horizontal, the maxillary not reaching to eye. Isthmus wide. Breast scaly. Lateral line nearly straight. Eye large, high up, $3\frac{1}{2}$ in head. Pale yellowish; the scales above dark-edged; snout blackish; a plumbeous lateral band; fins plain. Head $4\frac{2}{3}$; depth $4\frac{2}{3}$. D. 8; A. 7; scales 6–43–5; teeth 4–4. L. $3\frac{1}{2}$ inches. Kanawha River.

(Cope, Proc. Acad. Nat. Sci. Phila. 1867, 96.)

310. P. mirabilis (Grd.) Jordan.

Body moderately slender. Head short, rather blunt anteriorly. Mouth small, the maxillary not reaching to the eye. Eye large, 4 in head. Olivaceous; a silvery lateral band and a dusky spot at base of caudal. Head 4; depth $4\frac{1}{4}$. D. 8; A. 7; scales 6–51–5 (teeth 1, 4–4, 1?). L. $3\frac{1}{2}$ inches. Arkansas River. (*Girard.*)

(*Exoglossum mirabile* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 191, and U. S. Pac. R. R. Surv. x, 256: *Exoglossum mirabile* Günther, vii, 188: *? Sarcidium scopiferum** Cope,

* Body moderately elongate, the back not elevated. Caudal peduncle stout. Head rather short and thick, with prominent but obtuse muzzle. Mouth small, horizontal, wholly inferior, the maxillary not reaching the eye. Top of head flat. Lateral line nearly straight. Eye large, $4\frac{1}{5}$ in head. Yellowish, with a silvery lateral band, which terminates in a black caudal spot; no dorsal band; fins plain. Head $4\frac{1}{2}$; depth $4\frac{3}{5}$. D. 8; A. 7; scales 6–44–5; teeth 4–4. L. 3 inches. (*Cope.*) Missouri River.

Hayden's Geol. Surv. Wyom. 1870, 440, 1872; Jordan, Bull. Hayden's Geol. Surv. Terr. iv, No. 3, 665 (a rather chubby specimen from the Rio Grande, with scales 6–45–7, the breast naked, is referred by us to this species): *? Phenacobius teretulus* var. *liosternus* Nelson, Bull. Ills. Mus. Nat. Hist. i, 1876, 46.)

** Scales small, about 60 in the lateral line.

311. P. catostomus Jordan.

Body rather slender, nearly terete, scarcely compressed at all, back not elevated, caudal peduncle stout. Head very large, the muzzle blunt and heavy, the cheeks tumid. Mouth small, inferior, altogether below the level of the eye, the maxillary barely reaching to the nostrils. Eyes large, high up, behind middle of head, and $3\frac{1}{2}$ in its length. Scales small, thin, and loosely imbricated; the back and belly scaled; chest naked. Lateral line nearly straight. Twenty-two scales in front of dorsal. Fins all small. Width of isthmus $2\frac{1}{2}$ in head. Pale olivaceous; white below; a silvery lateral band, underlaid by dusky, which forms a vague blotch at base of caudal; back dusted with dark specks; top of head black; a yellowish vertebral line. Head $4\frac{1}{2}$; depth $5\frac{2}{3}$. D. 8; A. 7; scales 7–60–5; teeth 4–4. L. 4 inches. Alabama River.

(Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 332.)

312. P. uranops Cope.

Body very slender, little compressed, back not elevated, caudal peduncle long and slender. Head long and rather slender, flat above, the muzzle broad, blunt, and projecting. Mouth entirely inferior, larger than in the other species, with conspicuous lips. Eye large, placed very high, behind the middle of the head, $3\frac{1}{2}$ in head. Scales small, 24 in front of dorsal. Lateral line straight. Chest and middle line of belly naked. Width of isthmus half length of head. Fins small. Head $4\frac{3}{4}$; depth 6. D. 8; A. 7; scales 7–60–6; teeth 4–4. Tennessee River.

(Cope, Proc. Acad. Nat. Sci. Phila. 1867, 96.)

89.—RHINICHTHYS Agassiz.

Black-nosed Dace.

(*Argyreus* Heckel, preoccupied in Entomology.)

(Agassiz, Lake Superior, 1850, 353: type *Cyprinus atronasus* Mitchill.)

Body rather elongate, not much compressed. Mouth small, subinferior, normal, the upper jaw not protractile, the upper lip continuous with the skin of the forehead, a barbel terminal on the maxillary. Teeth mostly 2, 4–4, 2, hooked, without grinding surface. Intestinal

canal short. Scales very small. Lateral line continuous. Dorsal fin inserted behind the ventrals. Anal basis short. Size small. Coloration dark, rosy in spring. (*ῥίν*, snout; *ἰχθυς*, fish; the snout in most species being prominent.)

313. R. cataractæ (Val.) Jor.—*Long-nosed Dace.*

Body elongate, little compressed, not elevated. Head long, the muzzle flattened, narrowed, and extremely prominent, the mouth being entirely inferior and horizontal. Eye nearly median, its diameter contained twice in the length of the snout, about 5 times in head. Isthmus wide. Barbel evident. Lateral line commencing opposite the upper posterior angle of the opercle, decurved. Pectoral fins enlarged in the males. Color olivaceous, paler below, with numerous dusky punctulations; the back often almost black; some of the scales usually irregularly darker, producing a mottled appearance; no black lateral bands; young specimens with a dusky lateral shade; a blackish spot on the opercle; males in spring with the lips, cheeks, and lower fins crimson. Head 4; depth 5. D. 8; A. 7; scales 14–65–8; teeth 2, 4–4, 2. L. 5 inches. New England to Virginia and Wisconsin; frequenting clear and boisterous streams and rock-pools.

(*Gobio cataractæ* Cuv. & Val. xvi, 315, 1842: *Leuciscus nasutus* Ayres, Bost. Journ. Nat. Hist. iv, 299, 1843: *Argyreus nasutus* Cope, Cypr. Penn. 369: *Rhinichthys nasutus* Günther, vii, 189: *Ceratichthys cataractæ* Günther, vii, 176: *Rhinichthys marmoratus* Agassiz, Lake Superior, 354: *Rhinichthys marmoratus* Günther, vii, 189.)

314. R. maxillosus Cope.

Body elongate, not elevated. Head long, the muzzle long and projecting, as in the preceding species, but rather heavier, the mouth broader, the maxillary extending nearly to the eye. Barbel evident. Eye small, high up, median, $5\frac{1}{4}$ in head. Fins small, caudal not deeply forked. Lateral line decurved. Silvery; darker above; a dusky lateral shade, at least in the young. Head 4; depth 5. D. 8; A. 7; scales 11–70–8. L. 5 inches. Upper Missouri region southeastward. Very close to the preceding.

(Cope, Proc. Acad. Nat. Sci. Phila. 1864, 278.)

315. R. transmontanus Cope.

This species, the common *Rhinichthys* of New Mexico, differs from *Rhinichthys maxillosus* in having the dorsal fin equidistant between the base of the caudal and the end of the muzzle, and in having the longitudinal series of scales below the lateral line more numerous (12–13).

and equal to those above it. D. 8; A. 7; scales 13–70–13. Tributaries of the Rio Grande in Colorado and New Mexico. (*Cope.*)

(*Rhinichthys maxillosus* Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. v, 644, 1877 (not of Cope, 1864); Cope, Amer. Nat. July, 1879, 441.)

316. R. obtusus Agassiz.—*Brown-nosed Dace.*

Very similar to *R. atronasus*, but usually rather stouter, the barbel more distinct, the head a little shorter, and the coloration somewhat different. Back olivaceous, mottled with darker; sides with a rather faint brownish band, margined above and below with paler; belly silvery; a dusky blotch in the middle of the base of the dorsal fin; males with the pectoral fins enlarged, and with the lateral band rosy. Head 4; depth 4½. D. 7; A. 6; scales 4–63–8; teeth 2, 4–4, 2. L. 3 inches. Wisconsin to Georgia; abundant in clear brooks. Probably a variety of the next species.

(Agassiz, Amer. Journ. Sci. Arts, 1854, 357; Günther, vii, 190; Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 331: *Rhinichthys lunatus* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 278: *Rhinichthys meleagris* Agassiz, Amer. Journ. Sci. Arts, 1854, 357: *Rhinichthys meleagris* Nelson, Bull. Ills. Mus. Nat. Hist. i, 46: *Rhinichthys meleagris* Günther, vii, 190.)

317. R. atromasus (Mitch.) Ag.—*Black-nosed Dace.*

Body moderately elongate, little compressed. Head moderate, rather broad and flattish above. Snout moderate. Mouth small, horizontal, subterminal, the lower jaw included, barbel minute but probably always present, upper lip on the level of the lower part of the pupil, maxillary not reaching nearly to the eye. Eye small, nearly median, 1½ in snout, 4½ in head. Fins rather small; dorsal fin well back. Scales quite small, somewhat imbedded. Lateral line somewhat decurved. Color blackish above; some of the scales irregularly darker; a black band passing from snout through eye and along the sides of the body; a pale streak below this; belly silvery; males in spring with the lateral band and the lower fins, and sometimes the whole body, bright crimson; males in late summer with the lateral band scarlet or orange, the red color growing fainter later in the season. Head 4; depth 4½. D. 7; A. 7; Lat. l. 64; teeth 2, 4–4, 2. L. 3 inches. New England to Ohio and Virginia; very abundant in clear brooks and mountain streams.

(*Cyprinus atronasus* Mitch. Trans. Lit. & Phil. Soc. i, 460; Günther, vii, 191.)

90.—AGOSIA Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 186: type *Agosia chrysogaster* Grd.)

Body moderately elongate. Mouth moderate, normal, the premaxillaries protractile, the maxillaries with a terminal barbel. Teeth 4–4,

hooked, with grinding surface. Scales quite small. Lateral line continuous. Dorsal over or slightly behind ventrals. Anal basis short. Size, aspect, and coloration of *Rhinichthys* and *Apocope*. (A coined name, without meaning.)

318. A. chrysogaster Girard.

Body rather stout, the back slightly elevated. Head heavy, the snout bluntly conical, covered with tubercles in males in spring. Mouth small, nearly horizontal, the lower jaw included, premaxillary entirely below the level of the eye, the maxillary not reaching its anterior margin, barbel minute. Eye rather large, about 4 in head. Fins well developed. Lateral line somewhat decurved. Color olivaceous above, with black spots; yellow below; a black streak along the sides. Head $4\frac{1}{3}$; depth $4\frac{2}{5}$. D. 9; A. 8.; Lat. l. 90. L. $3\frac{1}{2}$ inches. Rio Gila, Arizona. (*Girard.*)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 187, and U. S. Mex. Bound. Surv. Ichth. 48.)

319. A. metallica Grd.

Stouter, the head shorter, and the snout more convex. Dorsal rather higher and narrower. Scales (in figure) considerably larger. Coloration and proportions essentially as in the preceding. Lat. l. 75. Rio Gila.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 187, and U. S. Mex. Bound. Surv. Ichth. 49.)

91.—APOCOPE Cope.

(Cope, Hayden's Geol. Surv. Mont. 1871, 472: type *Apocope carringtoni* Cope.)

Body somewhat elongate. Mouth normal, rather small, with thickish lips and a terminal maxillary barbel, premaxillaries protractile. Teeth mostly 1, 4–4, 1, hooked, without grinding surface. Scales very small. Lateral line weak, often more or less broken posteriorly. Dorsal fin inserted behind the ventrals. Anal basis short. Isthmus broad. Size small. Colors dusky, with red in spring. The species are closely related and difficult to separate, and the genus is scarcely distinct from *Agosia*. (ἀποκοπή, a deficiency, in allusion to the incompleteness of the lateral line.)

* Lateral line with 60–70 scales.

320. A. carringtoni Cope.

Body rather stout. Head blunt and heavy, the snout scarcely overhanging the mouth; maxillary not quite reaching the line of the orbit; barbels minute; isthmus wide. Eye $4\frac{1}{4}$ in head, $1\frac{1}{2}$ in interorbital

width. Dorsal fin slightly behind ventrals, nearer caudal than muzzle. Lateral line in the young running about half way to caudal, nearly complete, or wanting on some scales only in the adult. Olivaceous; a dark lateral band; dark shades along the back; males with the loral region and the bases of all the fins except the dorsal scarlet. Head $4\frac{1}{8}$; depth 5. D. 8; A. 7; scales 10–60–11; teeth 1, 4–4, 1. L. 4 inches. Utah to California; very abundant in rock-pools.

(Cope, Hayden's Geol. Surv. Mont. 1871, 472; Jordan & Henshaw, Rept. Chief Eng. U. S. Geog. Surv. W. 100th Mer. 1878, 191.)

321. A. nubila (Grd.) Jor. & Gilb.

This species is very similar to *A. carringtoni*, but in Girard's original types the head is quite slender, while in the latter species it is blunt and stout. Lateral line continuous, but broken and feeble posteriorly. Body stout. Mouth small, barbels small. Fins rather small. Color blackish, with a darker lateral shade. Head black above. Head $4\frac{1}{5}$; depth $4\frac{1}{5}$. D. 8; A. 7; Lat. l. 60. L. 4 inches. Washington Territory.

(*Argyreus nubilus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 186: *Argyreus nubilus* Girard, U. S. Pac. R. R. Surv. x, 244.)

322. A. vulnerata Cope.

Body elongate. Muzzle obtuse, not projecting. Mouth inferior, horizontal, maxillary not reaching line of orbit. Eye as long as muzzle, 4 in head. Dorsal fin behind line of ventrals, nearer caudal than snout. Barbels small. Olivaceous; yellow below; a blackish lateral band; head blackish above; males with the chin red. Head $4\frac{1}{3}$; depth $5\frac{1}{5}$. D. 8; A. 7; scales 12–65–12; teeth 1, 4–4, 1. L. $2\frac{1}{2}$ inches. Utah to California, Oregon, and Arizona; generally abundant in the mountain region.

(Cope, Hayden's Geol. Surv. Mont. 1871, 473; Cope, vol. v, Zoöl. U. S. Geog. Surv. W. 100th Mer. 1876, 646; Jordan & Henshaw, Rept. Chief Eng. U. S. Geog. Surv. W. 100th Mer. 1878, 191: *Tigoma rhinichthyoides* Cope, Hayden's Geol. Surv. Mont. 1871, 473: *Apocope couesi* Yarrow, vol. v, Zoöl. U. S. Geog. Surv. W. 100th Mer. 1876, 648.)

323. A. henshawii Cope.

Body rather elongate. Muzzle rather long, broad, obtuse, but overhanging the mouth. Barbel small. Eyes small, high up, shorter than snout. Ventral fins reaching anal, but not reached by the pectorals; dorsal fins originating somewhat behind base of ventrals. Color pale, with a few dark clouds on the sides and dark shades on head; lower fins red at base; young with dark cross-streaks. Head $4\frac{1}{4}$; depth $4\frac{1}{2}$. D. 9; A. 7; scales 14–62–10; teeth 1, 4–4, 1. Utah and Idaho; abundant in Provo River. Not very different from the preceding.

(*Rhinichthys henshawii* Cope, Proc. Amer. Phil. Soc. Phila. 1874, 133; Cope, vol. v, Zoöl. U. S. Geog. Surv. W. 100th Mer. 645.)

324. A. oscula (Grd.) Cope.

Differs from *A. henshavii* in having a longer and more attenuated body, and narrow, sharp-pointed muzzle. Base of dorsal intermediate between base of caudal and end of snout; ventrals reaching anal, but not reached by pectorals. Yellowish white above; bright yellow below; a broad blackish lateral band; a narrow black stripe around muzzle; males with the lower jaw and lower fins crimson in life. Head $4\frac{3}{4}$ ("in total length"); depth $7\frac{1}{2}$; eye $4\frac{1}{2}$ in head. D. 8; A. 7; scales 10–63–10. Colorado to Arizona. (*Cope.*)

(*Argyreus osculus* and *notabilis* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 186, and in U. S. Mex. Bound. Surv. Ichth. 47; Cope, vol. v, Zoöl. U. S. Geog. Surv. W. 100th Mer. 647.)

** Lateral line with 80–90 scales.

325. A. ventricosa Cope.

Body rather elongate. Muzzle obtuse, but narrowed anteriorly, not overhanging the mouth. Eye 4 in head, shorter than snout. Caudal peduncle stout. Barbels small, sometimes obsolete. Scales very small. Dusky olive above; a blackish lateral band. Males with the axils of the pectorals and ventrals scarlet; a scarlet spot above the gill-openings and one on the side of the muzzle. Head 4; depth $4\frac{3}{4}$. D. 8; A. 7; scales 18–89–15; teeth 1, 4–4, 1. L. $2\frac{3}{4}$ inches. New Mexico to Arizona and Oregon; abundant.

(*Ceratichthys ventricosus* Cope, Proc. Amer. Phil. Soc. Phila. 1876, 136; Cope, vol. v, Zoöl. U. S. Geog. Surv. W. 100th Mer. 648; Jordan & Henshaw, Rept. Chief Eng. U. S. Geog. Surv. W. 100th Mer. 1878, 192.)

92.—CERATICHTHYS Baird.

Horny Heads.

(*Nocomis* Grd; *? Hybopsis* Ag.)

(Baird, 1853, brief notice; Girard, Proc. Acad. Nat. Sci. Phila. 1856, 212: type *Semotilus biguttatus* Kirtland.)

Form various. Mouth terminal or inferior, with lips thin or somewhat fleshy, a conspicuous barbel terminal on the maxillary, premaxillaries projectile. Teeth 4–4, or 1, 4–4, 1 or 0, hooked, without evident grinding surface. Scales rather large. Lateral line continuous. Dorsal fin inserted over, in front of, or slightly behind ventrals; anal basis short. A large and varied group. (κέρας, horn; ἴχθυς, fish; from the nuptial tubercles of the typical species.)

The species may be thus divided:

* Species of large size, with the mouth anterior, the lower jaw included; the dorsal fin slightly behind the ventrals (CERATICHTHYS).

biguttatus, micropogon, symmetricus.

** Species of small size, with the mouth subinferior and horizontal; the dorsal fin inserted slightly in front of the ventrals, and the scales generally large and silvery (? HYBOPSIS Agassiz).

b. Teeth two-rowed.....*cumingi, lucens, amblops, rubrifrons, hypsinotus.*

bb. Teeth one-rowed.....*dissimilis, sterletus, æstivalis, gelidus.*

*** Species of small size, with the mouth subinferior and horizontal, with thickened lips; the dorsal fin inserted slightly behind the ventrals, usually with a black blotch on its last rays; scales rather large, silvery.

labrosus, zanemus, monachus.

* Species of large size, with the mouth anterior, the lower jaw included; the dorsal fin slightly behind the ventrals. (*Ceratichthys.*)

326. C. biguttatus (Kirt.) Grd.—*Horny Head; River Chub; Jerker.*

Body rather robust, little elevated, little compressed. Head large, rather broadly rounded above; the snout conical, bluntish. Mouth rather large, subterminal, little oblique, the lower jaw somewhat the shorter, the upper lip rather below the level of the eye, and the maxillary not reaching to the front of the eye. Eye small, median, high up. Suborbitals very narrow; preorbital large. Fins moderate; the dorsal rather posterior, slightly behind the insertion of the ventrals; caudal broad, little forked. Scales large, not crowded anteriorly, 18 rows in front of the dorsal. Lateral line somewhat decurved. Color bluish olive; sides with bright green and coppery reflections; a curved dusky bar behind the opercle; scales above with dark borders; belly pale, but not silvery, rosy in spring males; fins all pale orange, without black spot. Males in spring with a crimson spot on each side of the head; the adults with the top of the head swollen, forming a sort of crest, which is sometimes a third of an inch higher than the level of the neck and is covered with large tubercles; young with a dark caudal spot. Barbel well developed. Head 4; depth $4\frac{1}{4}$. D. 8; A. 7; scales 6–41–4; teeth 1, 4–4, 1, or 1, 4–4, 0, sometimes 4–4. L. 6–9 inches. Pennsylvania to the Great Basin of Utah and southward; everywhere abundant. The most widely diffused of our *Cyprinidæ*. Western specimens usually have the teeth in two rows.

(*Semotilus biguttatus* Kirtland, Bost. Journ. Nat. Hist. 1840, iii, 344; Cope, Cypr. Penn. 1866, 366; Günther, vii, 178: *Nocomis nebrascensis* and *? Nocomis bellicus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 213: *Ceratichthys cyclotis* and *stigmaticus* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 277, 278: *Ceratichthys cyclotis* Günther, vii, 178: *Ceratichthys stigmaticus* Günther, vii, 179.)

327. C. micropogon Cope.

Body moderately stout. Head much as in *Minnilus cornutus*, broad, the muzzle obtuse, the profile rounded, descending. Mouth slightly oblique, its angle opposite front of the orbit. Eye $3\frac{1}{4}$ in head. Barbel minute. Caudal peduncle slender. Yellowish brown, with brown ver-

tebral band; a brown lateral shade. Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. D. 8; A. 7; scales 6–40–3; teeth 4–4. L. $3\frac{1}{2}$ inches. One specimen known, from Conestoga River, Pennsylvania. Perhaps a variation of the preceding. (*Cope.*)

(Cope, Proc. Acad. Nat. Sci. Phila. 1864, 277; Günther, vii, 179.)

328. C. symmetricus (Baird & Girard) J. & G.

Body elongate, slender, moderately compressed, not elevated. Head short, rather slender and pointed. Mouth small, little oblique, the lower jaw included. Eye large, anterior, longer than snout, 3 in head. Barbel small, but evident. Scales small, rather loosely imbricated. Lateral line strongly decurved. Dorsal slightly behind ventrals. Coloration pale; scales dotted with black; cheeks silvery. Head $4\frac{2}{3}$; depth 6. D. 8; A. 8; scales 9–58–4; teeth 4–4, without grinding surface. L. 6 inches. Rivers of California.

(*Pogonichthys symmetricus* B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 136: *Leucosomus symmetricus* Günther, vii, 267.)

** Species of small size, with the mouth subinferior and horizontal; the dorsal fin inserted slightly in front of the ventrals, and the scales generally large and silvery. (*Hybopsis* Agassiz.*)

b. Teeth two-rowed.

329. C. cumingi Günther.

Barbels minute. Eye entirely in the anterior half of the length of the head, and nearly as long as the snout, which is obtuse, rounded, convex, the mouth being subinferior. Interorbital space convex, as wide as the orbit. Suborbital ring extremely narrow. Origin of dorsal fin a little behind ventrals, somewhat nearer root of caudal than end of snout. Pectorals not reaching ventrals. A grayish silvery band from gill-opening to the root of caudal, where it terminates in a black spot. Head $4\frac{1}{3}$; body 5. D. 8; A. 8; scales 6–45–6; teeth one-rowed? L. $3\frac{1}{2}$ inches. (*Günther.*) "California"?

(Günther, vii, 177.)

330. C. lucens Jordan.

Body elongate, compressed, the back somewhat elevated from the occiput to the base of dorsal, thence rapidly declined to the long and slender caudal peduncle. Head short, compressed, the cheeks nearly vertical. Interorbital space rather broad and flat, somewhat grooved. Eye very large, circular, high up, placed nearly midway of the length of the head, its diameter about equal to the length of the snout and

* Agassiz, Amer. Journ. Sci. Arts, 1854, 358: type *Hybopsis gracilis* Ag. (ὑβος, gibbous; ὀψις, face.)

scarcely greater than the width of the interorbital space. Preorbital bone large, oblong, conspicuous, and silvery. Mouth rather small, horizontal, the lower jaw included, the edge of the premaxillary below the level of the eye, the maxillary not reaching to the vertical from the front of the orbit. Barbel quite small. Snout boldly and abruptly decurved much as in *C. amblops*, the tip of the snout thickened, forming a sort of pad. Lateral line decurved. Rows of scales along the back converging behind the dorsal where the upper series run out, as in *Minnilus cornutus*. Fins rather higher and more falcate than in *C. biguttatus*. The dorsal fin inserted well forward, over ventrals. Pectoral fins pointed, not reaching ventrals, ventrals not reaching vent. Teeth 4–4, hooked, without grinding surface. Translucent greenish above; sides and below brilliantly silvery; cheeks and opercles with a bright silvery lustre; fins plain; a slight plumbeous lateral shade. Head $4\frac{1}{3}$; depth 4. D. 8; A. 8; scales 5–42–4. L. 5 inches. Falls of the Ohio.

(Jordan, Proc. U. S. Nat. Mus. 1879, 238.)

331. C. amblops (Raf.) Grd.—*Silver Chub.*

Body rather slender, somewhat heavy anteriorly, not much compressed. Head large, somewhat flattened and broad above. Eye very large, longer than snout and longer than interorbital space, 3 in head. Mouth horizontal, subinferior, and rather small. Muzzle bluntly decurved. Upper lip below level of orbit, maxillary not reaching the line of the front of the orbit. Barbel evident. Fins moderate. Lateral line somewhat decurved. Sixteen scales before dorsal. Color translucent greenish above; scales somewhat dark-edged; sides with a bright silvery band, which overlies dark pigment, so that sometimes a plumbeous or even blackish band appears; a dark band through eye around snout; males without tubercles or red coloration. Head 4; depth 5. D. 8; A. 7; scales 5–38–4; teeth 1, 4-4, 1. L. 2–4 inches. Ohio Valley and southward. Southern specimens (var. *winchelli*) have the head narrower and the barbel rather shorter.

(*Rutilus amblops* Raf. Ichth. Oh. 1820, 51: *? Hybopsis gracilis* Agassiz, Amer. Journ. Sci. Arts, 1854, 358: *Gobio vernalis* and *Hybopsis winchelli* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 188, 211: *Ceratichthys hyalinus* Cope, Journ. Acad. Nat. Sci. 1869, 236: *Ceratichthys hyalinus* Günther, vii, 179: *Nocomis amblops* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 328.)

332. C. rubrifrons Jordan.

General form of the preceding. Head long, narrower than in the preceding, longer than in the next. Eye moderate, $3\frac{1}{3}$–$3\frac{1}{2}$ in head, wider than the interorbital space. Mouth smaller, inferior, overhung by the bluntly

decurved but not very broad muzzle. Barbels quite long and distinct. Thirteen scales in front of the dorsal. Fins well developed; the first developed rays of the dorsal about twice the height of the last. Pale olivaceous; sides with a plumbeous silvery band, in some specimens forming a stripe through eye and snout, and a dark spot at base of caudal; cheeks silvery; snout in males red, with numerous dust-like tubercles; specimens in high spring coloration have the fins largely red. Head 4; depth 5. D. 8; A. 7; scales 5–36–3; teeth 1, 4–4, 0. L. 3 inches. Basin of the Altamaha, Georgia.

(*Nocomis rubrifrons* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 330.)

333. C. hypsinotus Cope.

Body much stouter, more elevated, and more compressed than in the preceding. Head short, broad above, much smaller and more conical than in the preceding. Outline of back rather abruptly declining behind front of dorsal fin, so that the base of the fin is oblique. Mouth inferior, horizontal, small, the maxillary reaching the line of the orbit. Barbels small. Eye small, $3\frac{1}{2}$ in head. Color silvery, with a double series of black specks along the lateral line, and a lateral band of dusted blackish, which passes through eye and snout; males with the fins bright red, and the body with a deep violet lustre, as in *Minnilus rubricroceus*. Head $3\frac{3}{4}$; depth 4. D. 8; A. 8; scales 5–40–3; teeth 1, 4–4, 1. L. 3 inches. Santee Basin, in North Carolina and South Carolina.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 458; Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 1878, 25. *Ceratichthys leptocephalus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 213, from Salem, N. C., may be the same, but the description is wholly insufficient for determination.)

bb. Teeth one-rowed.

334. C. dissimilis (Kirtland) Cope.—*Spotted Shiner.*

Body long and slender, little compressed, with long caudal peduncle. Head long, rather flat above, the snout somewhat bluntly decurved, projecting a little beyond the rather small, horizontal mouth; lower jaw included; both jaws with the skin hard in front, forming a sort of lip laterally. Barbel considerably shorter than pupil, maxillary not reaching nearly to orbit. Eye very large, high up, somewhat directed upward, rather behind the middle of the head, forming more than one-third the length of the head. Opercle small. Dorsal rather large, its posterior border oblique; anal small; caudal well forked; pectoral rather long. Scales rather large, 22 in front of dorsal. Lateral line nearly straight. Olivaceous; sides silvery, with a bluish lateral band, which is widened into several dusky spots, formed by dark punctulations,

and most distinct posteriorly; a dusky band on head, through eyes and snout; fins plain. Head $4\frac{1}{2}$; depth $5\frac{1}{2}$. D. 8; A. 7; scales 6–47–5; teeth 4–4, often with slight grinding surface. L. 5 inches. Ohio Valley and tributaries of the Great Lakes.

(*Leuciscus dissimilis* Kirtland, Bost. Journ. Nat. Hist. iii, 341, 1840: *Ceratichthys dissimilis* Cope, Cypr. Penn. 367: *Ceratichthys dissimilis* Günther, vii, 177.)

335. C. sterletus Cope.

Body slender, with long caudal peduncle, the least depth of which is little more than a third of the greatest depth of the body. Head long and slender, the muzzle much projecting and broadly rounded. Mouth moderate, inferior, the maxillary not reaching the front of orbit. Barbels conspicuous. Eye moderate, $4\frac{1}{2}$ in head. Fins rather long, the caudal deeply forked. Color silvery; sides with a few dusky scales; forehead pink in the males, as in *C. rubrifrons*. Head 4; depth $4\frac{2}{3}$. D. 8; A. 7; scales 6–36–5; teeth 4–4. Rio Grande, in New Mexico. (*Cope.*)

(Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 652, 1876.)

336. C. æstivalis (Grd.) Cope.

Head contained about $4\frac{1}{2}$ times in the total length. Differs from *G. gelidus* and *G. vernalis*, its American congeners, by a rather compressed body, elevated and arched upon its middle region, and tapering rapidly towards the peduncle of the tail. The snout is more protruding than in *G. gelidus*, the eye larger, and the ventral fins inserted somewhat more forwards. The scales are also larger (about 36 in the lateral line in the figure), deeper than long, anteriorly subtruncated and posteriorly rounded, with radiating furrows upon the latter section only. D. I, 8; A. I, 7, etc. The color is yellowish brown, somewhat lighter beneath than above, with a silvery streak along the middle of the flanks. Rio San Juan, Cadareita, New Leon. (*Girard.*) (Of course these little fishes have no intimate relation with the European genus *Gobio*, which is an ally of *Semotilus*, with the teeth 3, 5–5, 3, and the barbel lateral and very long.)

(*Gobio æstivalis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 189.)

337. C. gelidus (Grd.) Jor.

Body very slender, not elevated. Head slender and elongate, the snout prominent and tapering. Eye small, rather high, 4 in head. Mouth small, subterminal, the maxillary not extending to the eye. Fins large. Lateral line decurved. Scales rather large. Coloration silvery; a dusty lateral streak, and a blackish spot at base of caudal.

Head $3\frac{3}{4}$; depth $5\frac{1}{2}$. D. 8; A. 8; Lat. l. 44. L. 2 inches. Milk River, Montana. (*Girard.*)

(*Gobio gelidus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 188, and U. S. Pac. R. R. Surv. 248.)

*** Species of small size, with the mouth subinferior and horizontal, with thickened lips; the dorsal fin inserted slightly behind the ventrals, usually with a black blotch on its last rays; scales rather large, silvery.

338. C. labrosus Cope.

Body slender, little compressed, the back not elevated. Head long, gently decurved to the muzzle, which scarcely overhangs the mouth. Mouth entirely horizontal, the maxillary reaching the orbit. Eye $3\frac{3}{4}$ in head. Dorsal inserted slightly behind origin of ventrals (not directly over, as stated in original description). Lips thickened. Barbels very long. Color silvery; sides sometimes with vague, dusty cross-bars. Head $4\frac{1}{4}$; depth $5\frac{1}{2}$. D. 8; A. 8; scales 6–34–4; teeth 1, 4–4, 1. L. $2\frac{1}{2}$ inches. Catawba River, North Carolina. (*Cope.*)

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 458.)

339. C. zanemus Jordan & Brayton.

Body long and slender, little compressed. Head rather long, narrow, and pointed, very slender in young specimens, stouter in adults. Snout decurved in profile, an angle in front of the nostrils Muzzle long, overhanging the large mouth. Lips much thickened, the lower with a conspicuous internal fringe of papillæ. Barbels extremely long, longer than in any other of our *Cyprinidæ*, their length more than half the diameter of the eye. Eye moderate, nearly median, $3\frac{1}{3}$ in head. Scales moderate, closely imbricated, 16 in front of dorsal. Lateral line slightly decurved anteriorly. Fins rather small. Caudal deeply forked, its peduncle long and slender. Coloration pale; a small, round black spot at base of caudal; dorsal scales dark-edged; a dark lateral streak, obsolete anteriorly; large specimens with a large dark patch on the last rays of the dorsal, as in *Cliola analostana;* base of the caudal with dark points; males in spring with the head and neck profusely tuberculate and the fins flushed with crimson. Head $4\frac{1}{4}$; depth $4\frac{1}{4}$. D. 8; A. 7; scales 5–40–3; teeth 1, 4–4, 1. L. 3 inches. Saluda River, South Carolina.

(Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 25, 1878.)

340. C. monachus Cope.

Body slender, somewhat compressed, not much elevated. Head long and rather slender, flattish above, with projecting muzzle. Mouth inferior, horizontal, small, the maxillary not reaching the eye, which is

rather small, $4\frac{1}{5}$ in head. Scales rather small. Lateral line somewhat decurved. Twenty-four scales in front of dorsal. Fins moderate. Color light olive; a metallic vertebral band; sides and belly silvery; no lateral band; a black spot at base of caudal; muzzle dusky; membrane of upper posterior part of dorsal fin black. Head 4; depth $5\frac{1}{4}$. D. 8; A. 8; scales 8–56–4; teeth 4–4. L. 4 inches. Tennessee River.

(Cope, Journ. Acad. Nat. Sci. Phila. 1867, 227.)

93.—COUESIUS Jordan.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 785, 1878: type *Nocomis milneri* Jordan = *Leucosomus dissimilis* Grd.)

Body elongate. Head normal, not depressed, the profile convex. Mouth terminal, normal, a well-developed barbel at the posterior end of the maxillary. Teeth 2, 4–4, 2, hooked, without grinding surface. Scales rather small. Lateral line continuous. Dorsal fin over or slightly behind ventrals; anal basis short Size rather large. (Dedicated to Elliott Coues.)

* Scales small, 60–70 in the course of the lateral line.

† About thirty scales in a transverse series from dorsal to ventrals.

341. C. squamilentus (Cope) Jor.

Form stout, profile nearly plain. Muzzle not prominent. Mouth horizontal, the maxillary not reaching the orbit. Eye rather small, $4\frac{2}{3}$ in head, shorter than snout. Isthmus wide. Barbel quite small. Dorsal fin slightly in advance of ventrals, behind middle of the body. Scales quite small. Olivaceous above; sides silvery; a lateral band of dark punctulations. Fins plain. Head $3\frac{4}{5}$; depth 5. D. 8; A. 7; scales 17–66–14; teeth 2, 4–4, 1. Henry's Fork of Green River, Wyoming. (*Cope.*)

(*Ceratichthys squamilentus* Cope, Hayden's Geol. Surv. Wyom. 1870, 442, 1872.)

†† About 20 scales in a transverse series from dorsal to ventrals.

342. C. dissimilis (Grd.) Jor.

Form of *Semotilus corporalis*, but more elongate and less compressed. Head flattish above, the snout broad, projecting over the large, oblique mouth, maxillary reaching front of eye. Barbel very evident. Eye large, as long as snout, about 4 in head, $1\frac{1}{2}$ in interorbital space. Scales small, crowded forwards, those on the back smaller. Dorsal fin beginning over last ray of ventrals. Dusky above; sides somewhat silvery; an obscure dusky band through eye around snout; fins plain. Head $4\frac{1}{2}$;

depth 4½. D. 8; A. 8; scales 11–68–7; teeth 2, 4–4, 2. L. 6 inches. Lake Superior to Upper Missouri region; probably abundant.

(*? Gobio plumbeus* Agassiz, Lake Superior, 366: *Leucosomus dissimilis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 189, and U. S. Pac. R. R. Surv. x, 250: *Nocomis milneri* Jordan, Bull. U. S. Nat. Mus. x, 64, 1876; Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 784, 1878.)

343. C. prosthemius (Cope) Jor.

Body fusiform, rather slender. Head small, the muzzle abruptly descending. Mouth rather small, somewhat oblique, the maxillary not reaching to the orbit. Eye 4 in head. First ray of dorsal opposite ventrals. Color dusky; a plumbeous lateral band; white below; fins plain. Head 5; depth 5. D. 8; A. 7; scales 11–63–8, somewhat crowded anteriorly; teeth 2, 4–4, 2. L. 6 inches. Upper Great Lakes.

(*Ceratichthys prosthemius* Cope, Cypr. Penn. 1866, 365: *Ceratichthys plumbeus* Günther, vii, 442.)

** Scales rather large, about 50 in the lateral line and 10 in a transverse series.

344. C. physignathus (Cope) Jor.

Body slender, the caudal peduncle stout. Head wide and depressed. Dorsal outline little arched, the profile descending steeply to the lip. Lower jaw included, maxillary reaching anterior border of orbit. Barbels well developed. Eye 1⅔ in head, 1½ in muzzle. Twenty-three rows of scales in front of dorsal. Dorsal fin inserted in front of ventrals. Olivaceous above, white below; a plumbeous lateral band; fins plain. Head 3⅔; depth 5. D. 8; A. 8; scales 5–49–4; teeth 2, 4–4, 2. Arkansas River at Pueblo. (*Cope.*)

(*Ceratichthys physignathus* Cope, Wheeler's Expl. W. 100th Mer. v, 651, 1876.)

94.—PLATYGOBIO Gill.

Flat-headed Chubs.

(Gill, Proc. Bost. Soc. Nat. Hist. 1861: type *Pogonichthys communis* Grd.)

Body rather elongate, somewhat compressed. Head rather short, broad and depressed above. Mouth normal, rather large, subterminal, with a well-developed barbel at its angle, at the extremity of the maxillary. Scales large. Lateral line continuous. Dorsal inserted anteriorly, rather in front of the ventrals. Teeth 2, 4–4, 2, with rather narrow grinding surface. Size large. (πλατύς, broad; Latin *gobio*, a gudgeon; the broad, flat head resembling the head of a *Gila*.)

345. P. gracilis (Rich.) Gill & Jor.—*Flat-headed Chub.*

Body rather elongate, somewhat compressed, little elevated. Head small and short, its upper surface very broad and depressed, the inter-

orbital width being nearly half the length of the head. Mouth rather large, slightly oblique, the upper lip on the level of the lower part of the eye, the maxillary reaching the line of the front of the eye, the upper jaw very protractile, the lower jaw included. Eye small, rather high up and anterior, 6 in head. Fins rather large; dorsal in advance of the middle of the body; caudal peduncle rather stout. Scales large and silvery; lateral line decurved; 23 scales in front of dorsal. Coloration pale; back bluish; sides and below silvery; head mostly white; fins pale. Head $4\frac{1}{4}$; depth $4\frac{3}{4}$. D. 8; A. 8; scales 6–50–5; teeth 2, 4–4, 2. L. 12 inches. Rocky Mountain region from the Kansas and Yellowstone Rivers to the Saskatchawan; abundant.

(*Cyprinus* (*Leuciscus*) *gracilis* Rich, Fauna Bor.-Amer. Pisc. 1836, 120: *Pogonichthys communis* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 188, and U. S. Pac. R. R. Surv. x, 247: *Pogonichthys communis* Gill, Ichth. Captain Simpson's Surv. 408: *Pogonichthys* (*Platygobis*) *gulonellus* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 277: *Leuciscus gracilis* Günther, vii, 240: *Leucosomus communis* and *gulonellus* Günther, vii, 267, 268.)

346. P. pallidus Forbes, sp. nov.

"The depth is contained $4\frac{2}{3}$ times in length, and the head 4. The eye equals the snout, and enters length of head $3\frac{3}{4}$ times and the interorbital space twice. The head is flat above and the snout overhangs the mouth, which is large and wide, with a maxillary barbel about one-third as long as the eye. The mandible reaches a vertical line drawn through the middle of the iris in front. The greatest depth of the head enters its length $1\frac{3}{4}$ times. The scales are 6–55–5, with 22 rows before dorsal, where they are much smaller than elsewhere. The lateral line is straight, except for a few scales in front. The pectoral fins are large and pointed, reaching the ventrals, and the latter attain the vent. The front of the dorsal is situated a trifle before the ventrals and a little nearer snout than caudal. D. 8; A. 8. The color in alcohol is plain, with a plumbeous lustre along sides, and traces of a dusky lateral stripe behind dorsal. The pharyngeal teeth are stout, 2, 4–4, 2, hooked, with masticatory surface. L. $2\frac{1}{2}$ inches. One specimen from the Ohio River at Cairo, probably adult, as the snout is tuberculate." (*Forbes*, MSS.)

95.—SEMOTILUS Rafinesque.

Chubs.

(*Leucosomus* Heckel; *Chilonemus* Baird.)

(Rafinesque, Ichth. Oh. 49, 1820: type *Semotilus dorsalis* Raf. = *Cyprinus corporalis* Mitch.)

Body robust. Head large. Mouth terminal, the upper jaw protractile, a small barbel on the maxillary just above its extremity. In-

testinal canal short. Teeth 2, 5–4, 2, hooked, without masticatory surface. Scales moderate. Lateral line continuous. Dorsal more or less posterior to ventrals. Anal basis short. Species of large size, differing from *Squalius* in the presence of a maxillary barbel. (*σῆμα*, banner—*i. e.*, dorsal fin; the second part of the word was elsewhere used by Rafinesque to mean "spotted".

* Insertion of dorsal fin evidently behind ventrals and notably behind the middle of the body; scales reduced in size and much crowded anteriorly; a black spot at base of dorsal in front. (*Semotilus.*)

347. S. corporalis (Mitch.) Putn.—*Chub; Horned Dace.*

Body stout, the dorsal outline arched in front of the dorsal, the body tapering backward from a point considerably in advance of the dorsal, so that the base of that fin is oblique. Head large and heavy, broad and rounded above. Snout broad. Mouth broad, oblique, the lower jaw slightly included, the upper lip just below the level of the pupil, the maxillary barely reaching the front of the pupil; maxillary barbel small, not evident in specimens of less than 2 or 3 inches in length. Eye rather small, about 5 in head. Scales small, considerably crowded and reduced anteriorly, about 30 series in front of the dorsal fin. Lateral line considerably decurved. Fins small; the dorsal well behind ventrals, its last ray well in advance of the base of anal. Color dusky bluish above; sides with a vague dusky band, black in the young, disappearing in the adult; belly creamy, rosy-tinted in the males in spring; dorsal fin always with a conspicuous black spot at the base in front, which is bordered with red in the male; a dark vertebral line; scales everywhere edged with dark punctulations; a dusky bar behind opercle; males with the snout coarsely tuberculate in spring. Head $3\frac{3}{4}$; depth 4. D. 7; A. 8; scales 9–58–6 [those in the lateral line varying from 52 (? var. *pallidus*, Alabama to Arkansas) to upwards of 65]; teeth 2, 5–4, 2. L. 10 inches. Western Massachusetts to Georgia and Upper Missouri; everywhere very abundant, ascending small streams.

(*Cyprinus corporalis* and *atromaculatus* Mitchill, Amer. Month. Mag. ii, 324: *Semotilus dorsalis* and *cephalus* Rafinesque, Ichth. Oh. 49: *Leuciscus iris* and *storeri* Cuv. & Val. xvii: *Semotilus corporalis* Cope, Cypr. Penn. 363: *Leucosomus corporalis* Günther, vii, 269: *Leucosomus pallidus* (Lat. l. 52), *Leucosomus incrassatus* (Lat. l. 64), *Semotilus macrocephalus*, and *Semotilus speciosus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 251, 252, 204.)

348. S. thoreauianus Jordan.

Body short and rather stout, abruptly narrowed behind dorsal. Head short and thick, almost round. Mouth large, oblique, the jaws equal.

Barbel lateral, well developed. Eye small, 5 in head. Cheeks swollen. Scales larger than in *S. corporalis*, not much crowded forward. Lateral line much decurved. Dorsal fin entirely behind ventrals, its last ray over the first ray of the anal. Fins all small. Coloration of *S. corporalis;* the black dorsal spot distinct. Head $3\frac{3}{4}$; depth 4. D. 8; A. 7; scales 9–48–5; teeth 2, 5–4, 2. L. 4 inches. Flint River, Georgia.

(Jordan, Bull. U. S. Nat. Mus. x, 63, 1877.)

** Insertion of dorsal fin scarcely behind ventrals; scales nearly equal over the body; no conspicuous black dorsal spot. (*Leucosomus* Heckel.)

349. S. bullaris (Raf.) Jor.—*Fall-fish; Silver Chub.*

Body oblong, robust, little compressed. Head large, convex, the snout bluntly conic. Mouth large, terminal, somewhat oblique, the lower jaw included; premaxillary below the level of the eye, the maxillary barely reaching the front of the orbit. Eye moderate, rather high up and anterior, $4\frac{1}{2}$ in head. Barbel shorter than pupil, not evident in young specimens. Scales large, 22 in front of dorsal, not crowded anteriorly. Dorsal fin slightly behind middle of body, just behind ventrals. Fins moderate. Coloration brilliant; steel-blue above; sides and belly silvery; males in spring with the belly and lower fins rosy or crimson. Head 4; depth 4. D. 8; A. 8; scales 8–45–4; teeth 2, 5–4, 2. L. 18 inches. Largest of our Eastern *Cyprinidæ*. Abundant from Massachusetts to Virginia, east of the Alleghanies.

(*Cyprinus bullaris* Rafinesque, Amer. Month. Mag. and Crit. Rev. 1817, 120: *Leuciscus argenteus* and *pulchellus* Storer, Rept. Fish. Mass. 1839, 90: *Chilonemus pulchellus* Storer, Fish. Mass. 286: *Leucosomus cataractus* Baird: *Semotilus rhotheus* Cope, Cypr. Penn. 362: *Leucosomus pulchellus* Günther, vii, 268.)

96.—SYMMETRURUS Jordan.

(Jordan, Bull. Hayden's Geol. Surv. Terr. iv, 788, 1878: type *Pogonichthys argyreiosus* Girard.)

This genus differs from *Pogonichthys* chiefly in the caudal fin, which is developed as in *Semotilus* and other related genera, the two lobes equal, and the rudimentary basal rays comparatively few and small. The presence of grinding surface on the teeth and the position of the barbel chiefly distinguish *Symmetrurus* from *Semotilus*. (σύμμετρος, symmetrical; οὐρά, tail.)

350. S. argyriosus (Girard) Jor.

Body elongated, pretty strongly compressed. Head moderate, considerably compressed, the snout subconical. Mouth moderate, nearly horizontal, the lower jaw included, the maxillary reaching the front of

the eye. Eye large, $3\frac{1}{4}$ in head. Scales moderate, very silvery. Lateral line slightly decurved. Fins rather high. Dorsal fin rather in advance of ventrals. Caudal fin with its rudimentary rays few and little developed, the two lobes equal. Brownish above, with black dots; sides and below bright silvery. Head $4\frac{1}{4}$. D. 9; A. 8; Lat. l. 60; teeth 2, 5–(4, 2). L. 4 inches. Presidio, Cal.

(*Pogonichthys argyreiosus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 154: *Leucosomus argyreiosus* Günther, vii, 267.)

97.—POGONICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 136: type *Pogonichthys inæquilobus* B. & G.=*Leuciscus macrolepidotus* Ayres.)

Body elongate. Head small, conical. Mouth moderate, terminal, normal; maxillary with a well-developed barbel; premaxillaries protractile. Teeth 2, 4–5, 2, or 2, 5–5, 2, hooked, with well-marked grinding surface. Scales rather large. Lateral line continuous, decurved. Dorsal fin beginning rather in advance of ventrals. Anal basis short. Caudal fin with its rudimentary rays numerous and greatly developed, supported by strong apophyses of the caudal vertebræ, the upper lobe of the fin considerably longer than the lower. Intestinal canal short; peritoneum brownish. Species of large size. (πώγων, beard; ἰχθύς, fish.)

351. P. macrolepidotus (Ayres) Jor.—*Split-tail.*

Body elongate, somewhat compressed, the back a little elevated, the form somewhat that of *Cycleptus*. Head short, slender. Mouth moderate, nearly horizontal, the maxillary reaching front of orbit; lower jaw included; preorbital longer than deep. Eye large, $4\frac{1}{4}$ in head; interorbital space convex. Dorsal fin midway of the body, rather in front of the ventrals. Scales rather large, moderately imbricated. Lateral line decurved. Fins rather large; upper lobe of caudal half longer than head. Coloration uniform, somewhat silvery. Head $4\frac{1}{5}$; depth $3\frac{3}{4}$. D. 9; A. 8; scales 10–66–6; Vert. 26 + 15; teeth 2, 5–5, 2. L. 12 inches. Rivers of California. Singularly distinguished from our other *Cyprinidæ* by the great development of the upper lobe of the caudal and its rudimentary rays.

(*Pogonichthys inæquilobus* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 136 (August), and U. S. Pac. R. R. Surv. x, 245: *Leucosomus inæquilobus* Günther, vii, 271: *Leuciscus màcrolepidotus* Ayres, Placer Times and Transcript, 1854, May 30; Jordan, Proc. U. S. Nat. Mus. 1880, 326.)

97 (*b*). STYPODON Garman.

(Garman, Bull. Mus. Comp. Zoöl. viii, 90, 1881: type *Stypodon signifer* Garm.)

Body oblong, compressed, covered with large, deciduous scales. Lateral line complete, decurved. Dorsal and anal fins short. Mouth small,

anterior; premaxillaries protractile; fold of lower lip not crossing the symphysis; lower jaw trenchant, without horny covering; no barbels. Gill-rakers short. Pharyngeals strong. Teeth 3–3, of the *Mylochilus* type, more or less cylindrical, with rounded grinding surfaces, posterior more slender and subconical. (στύπος, stump; ὄδων, tooth.)

352. S. signifer Garman.

Dorsal and ventral outlines similar. Eye large, longer than snout. Mouth oblique, the maxillary not reaching front of eye. Lower jaw the longer. Pectorals not reaching ventrals, the latter to anal. Brown; silvery below; a broad brown lateral band, bordered above by a narrow silvery line. Head $3\frac{2}{3}$; depth $3\frac{2}{3}$. D. 8; A. 8; scales 6–35–2; "teeth 3–3, stout, stump-like, with convex summits." Lago de Parras, an isolated lagoon in Coahuila, Mexico. (*Garman.*)

(Garman, l. c. 90.)

98.—MYLOCHILUS Agassiz.

(*Mylocheilus* Agassiz, Amer. Journ. Sci. Arts, 1855, 229: type *Mylocheilus lateralis* Agassiz = *Leuciscus caurinus* Rich.)

Body elongate, not elevated, little compressed. Head rather short, conic, somewhat pointed. Mouth rather small, little oblique, the lower jaw included; maxillary with small barbel at its end; upper jaw protractile. Scales moderate not closely imbricated. Lateral line decurved. Dorsal fin beginning nearly opposite ventrals. Caudal fin with the rudimentary rays little developed. Anal basis short. Intestinal canal about as long as body. Teeth 2, 5–5, 2, or 2, 5–4, 2, two or three of those in the main row molar, much enlarged, blunt and truncate above. (A third deciduous row sometimes present, according to Girard, in this genus and in *Mylopharodon*; we have seen nothing of the kind.) Size large. (μύλος, grinder; χεῖλος, lip.)

353. M. caurinus (Richardson) Grd.—*Columbia Chub.*

Eye large, shorter than snout, 5 in head; interorbital space broad, convex. Mouth horizontal or nearly so, the maxillary not reaching the front of the eye; suborbital bones wide; preorbital elongate. Color dark above; sides silvery, a dark lateral band; below this a pale stripe; under which is a dark stripe which extends about to the vent; fins plain; belly and pale stripe red in spring males. Head $4\frac{2}{5}$; depth $4\frac{1}{2}$. D. 8; A. 8; scales 13–70–10; teeth 2, 5–5, 2. L. 12 inches. Streams

chiefly west of the Cascade Range, from California to British Columbia, often entering the sea; abundant.

(*Cyprinus* (*Leuciscus*) *caurinus* Richardson, Fauna Bor.-Amer. Fishes, 1836, 304: *Mylocheilus lateralis*, *caurinus*, and *fraterculus* Girard, U. S. Pac. R. R. Surv. x, 213–215: *Leucosomus caurinus* Giinther, vii, 270.)

99.—MYLOPHARODON Ayres.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 33: type *Mylopharodon robustus* Ayres = *Gila conocephala* B. & G.)

Body elongate. Head large, pike-like, the upper jaw not protractile; no barbel. Teeth 2, 4–5, 2; two or three of the teeth in the main row molar, truncate or bluntly rounded at the apex, much enlarged. Mouth terminal, rather large, with thickened lips. Scales rather small. Lateral line continuous. Dorsal fin inserted behind the ventrals. Anal basis short. Size very large. This genus has been confounded with *Mylochilus*, from which it differs in the non-protractility of the upper jaw. (Shortened from *Mylopharyngodon*—μύλος, grinder; φάρυγξ, pharynx; ὀδών, tooth.)

354. M. conocephalus (Baird & Girard) Grd.

Body elongate, subfusiform, compressed. Head broad and depressed, the snout tapering, almost wedge-shaped. Mouth horizontal, the jaws about equal, the maxillary extending to eye. Eye small, about 7 in head, 2½ in snout; preorbital elongate. Interorbital space as long as maxillary, 3 in head. Scales rather small, of the type usual in the Pacific coast *Cyprinidæ*. Dorsal fin a little behind ventrals. Caudal fin 1½ in head; caudal peduncle very long, 4½ in length. Color dark, paler below. Head 3½; depth 4⅔. D. 8; A. 8; scales 17–74–7. L. 18 inches. Rivers of California. Next to the species of *Ptychochilus* the largest of our *Cyprinidæ*.

(*Gila conocephala* B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 134: *Mylopharodon robustus* Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 33: *Mylopharodon conocephalus* and *robustus* Grd. U. S. Pac. R. R. Surv. x, 216; Günther, vii, 262.)

100.—PTYCHOCHILUS Agassiz.

(*Ptychocheilus* Agassiz, Amer. Journ. Sci. Arts, 1855, 229: type *Ptychocheilus gracilis* Agassiz = *Leuciscus oregonensis* Rich.)

Body elongated, little elevated, the caudal peduncle not contracted. Head long, slender, pike-like. Mouth nearly horizontal, widely cleft, the maxillary extending to below the eye, the upper lip rather below the level of the eye, the lower jaw included both anteriorly and laterally; no barbel; lips thick. Scales small, little imbricated, mostly

longer than deep. Lateral line decurved. Dorsal fin well back, somewhat behind ventrals. Anal basis short. Caudal fin strong, its rudimentary rays not greatly developed. Intestinal canal short. Teeth 2, 5–4, 2; the straight limb of the pharyngeal bone extremely long and slender, its teeth wide apart, subconical, scarcely compressed, and but slightly curved at tip, the hook being turned in the direction of the angle of the bone; no trace of grinding surface. Fishes of very large size, reaching a length of more than 4 feet, the largest of the Leuciscine *Cyprinidæ*. With a general resemblance to *Squalius* and *Gila*, this genus differ strongly in the form of the pharyngeal bones and teeth. (πτυχή, fold; χεῖλος, lip; the skin of the mouth behind the jaws being folded.)

355. P. oregonensis (Rich.) Grd.—*Sacramento "Pike."*

Body comparatively robust, with stout caudal peduncle. Mouth large, the maxillary reaching middle of the eye. Eye small, $2\frac{1}{2}$ in snout, $7\frac{1}{2}$ in head; in young specimens the eye is proportionately much larger. Lateral line strongly decurved, much nearer belly than back. Coloration olivaceous; the fins in spring with red or orange; scales thickly punctate with dark dots. Head 4; depth 5. D. 8; A. 8; scales 12–73–6 (13–79–9 in Columbia River specimens); teeth 2, 5–4, 2 (in all specimens examined; not 2, 5–5, 2, nor 2, 4–4, 2). L. 3–5 feet. Rivers of the Pacific slope, chiefly west of the Sierra Nevada. Largest of our *Cyprinidæ*.

(*Cyprinus* (*Leuciscus*) *oregonensis* Richardson, Fauna Bor.-Amer. iii, 305, 1836: *Ptychocheilus gracilis* and *major* Agassiz, Amer. Journ. Sci. Arts, 1855, 229: *Gila grandis* Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 18: *Ptychocheilus oregonensis* and *grandis* Girard, U. S. Pac. R. R. Surv. Fish. 298–300: *Leuciscus grandis* and *oregonensis* Günther, vii, 239.)

356. P. rapax Grd.

Body shorter and deeper than in *Pt. oregonensis*. Head similar, rather more depressed above. Mouth large, the maxillary reaching middle of eye. Lateral line moderately decurved, passing along the median line of the body between dorsal and ventrals. Dorsal inserted but little behind ventrals. Coloration dark; the sides somewhat clouded; fins plain. Head $3\frac{2}{3}$; depth $4\frac{2}{3}$. D. 9; A. 8; Lat. l. 78. L. 12 inches. Monterey, California. Perhaps not distinct from the foregoing.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 209, and U. S. Pac. R. R. Surv. x, 30θ.)

357. P. harfordi Jor. & Gilb.

Form of *P. oregonensis*, but more slender, the lateral line similarly much decurved. Scales much smaller than in *P. oregonensis*. Caudal less deeply forked, the pectoral longer, reaching $\frac{3}{5}$ to ventrals. Head 4;

depth $5\frac{3}{4}$. D. 8; A. 7; scales 17–90–9; teeth 2, 5–4, 2. L. 30 inches. Sacramento River, with *P. oregonensis*, but less common in the markets.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881.)

358. P. lucius Grd.—*Colorado "Pike".*

Body slender, elongate, with long, slender, depressed head; the form and general appearance being that of *Pt. oregonensis.* Maxillary reaching past anterior margin of the eye. Eye small, $2\frac{1}{4}$ in snout, 7 in head. Lateral line very strongly decurved. Fins low, the dorsal evidently behind ventrals. Scales very small. Coloration plain, darker above. Head $3\frac{1}{2}$; depth $5\frac{1}{2}$. D. 9; A. 9; Lat. l. 104; teeth 2, 4–5, 2. Colorado River; abundant.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 209, and U. S. Mex. Bound. Surv. Ichth. 65.)

101.—GILA Baird & Girard.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 368: type *Gila robusta* B. & G.)

Body elongate, little compressed, the back arched, especially in the adult; the caudal peduncle typically extremely long, slender, contracted, much narrower than the base of the caudal fin, which is widely forked, with its basal fulcra very much developed. Head in typical species broad, depressed, its profile concave. Mouth large, horizontal, and overlapped by the broad snout. Dorsal fin behind the middle of the body, slightly behind ventrals. Anal basis short. Intestinal canal short. Scales very small, little imbricated, sometimes scarcely imbricate at all, longer than deep, especially posteriorly. No barbel. Pseudobranchiæ present. Teeth 2, 5–4, 2, close set, compressed and hooked, without grinding surface. Vertebræ about 46 (5 or 6 more than usual in *Squalius*). Intestinal canal short; peritoneum dusky. Species of large size, the typical form remarkably unlike the usual Cyprinoid type, but varying through a series of intermediate forms directly into *Squalius*, so that the genus is hardly distinguishable by any definite technical character, unless the greater number of vertebræ be found constant. (*Gila*, the name of the river where the typical species was first obtained.)

* Head depressed anteriorly, the occipital region high, so that the profile is notably concave.

359. G. elegans B. & G.

The extreme species of this type. Body elongate, somewhat compressed, the region before the dorsal elevated, forming a sort of hump, the dorsal fin inserted on the downward slope of the back, so that its base is quite oblique. Caudal peduncle extremely long and slender, as

broad as deep, and nearly terete, its length (from end of anal to middle of base of caudal) 1½ times the length of the head, its least depth about one-seventh of its length, its extremity dilated and compressed. Head short, broad, the snout depressed and broadly rounded; the anterior part of the head from behind the eyes broad and depressed; the posterior part high, so that the profile forms a concave arc. Mouth rather large, nearly horizontal, the upper lip on the level of the lower part of orbit, the maxillary extending to the front of the orbit, the lower jaw on all sides included. Skin of the lower jaw hard. Eye small, anterior, placed low, 5 in head. Isthmus narrow. Gill-rakers rather weak. Fins all long and falcate. Pectorals reaching ventrals. Caudal fin deeply forked, its lobes long and pointed, the upper somewhat the longer; the rudimental basal rays strong, about 12 in number on each sides. Scales scarcely imbricated at all, on the caudal peduncle hardly touching each other, on the sides of the body much longer than deep; their texture thin and membranaceous; scales on back and belly much smaller than those on the sides. Coloration bluish above, pale below. Head 5; depth 5. D. 9; A. 10; scales 23–98–10; teeth 2, 4–5, 2. L. 12 inches. Colorado and Gila Rivers.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 369; Girard, U. S. Pac. R. R. Surv. x, 286: *Leuciscus elegans* Günther, vii, 241.)

360. G. robusta Baird & Girard.

Body elongate, the back elevated and the head depressed as in *G. elegans*, but the caudal peduncle notably stouter, its least depth about one-third its length, 3¾ in the length of the head. Mouth large, the upper lip on the level of the lower part of the orbit, the maxillary reaching past the front of the orbit. Fins rather lower than in *G. elegans*, the pectorals in the male reaching the ventrals, but falling short in the female. Eye small, low, anterior, 5–8 in head. Lateral line much decurved. Coloration plain. Head 4; depth 5. D. 9; A. 9; scales 17–90–10; teeth 2, 5–4, 2. L. 12 inches. Rio Colorado and Rio Gila.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 368, and U. S. Pac. R. R. Surv. x, 285: *Leuciscus robustus* Günther, vii, 241.)

361. G. grahami Baird & Girard.

General form of the preceding, with similar head and caudal peduncle, but with rather larger and more closely imbricated scales. Upper lip below level of eye, maxillary reaching front of orbit. Caudal fin less deeply forked, and pectorals not reaching nearly to ventrals. Colora-

tion plain, darker above. Head $3\frac{2}{3}$; depth $4\frac{1}{2}$. D. 9; A. 9; Lat. l. 82. Rio Gila and Colorado Basin.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 389; Girard, U. S. Mex. Bound. Surv. Ichth. 61: *Leuciscus grahami* Günther, vii, 242: *Ptychocheilus vorax* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 209, and U. S. Pac. R. R. Surv. x, 301. The type of "*vorax*" examined by us is a true *Gila*.)

362. G. affinis Abbott.

A species allied to the preceding, described as follows: "The body is slender, tail greatly attenuated, head constituting something more than one-fifth of the total length. Eye rather small, subelliptical, its diameter $6\frac{1}{2}$ times in the entire length of the head. The posterior extremity of the maxillary extends to a vertical line drawn posteriorly to the anterior edge of the orbit. Anterior margin of the dorsal fin nearer the base of the caudal than the extremity of the snout. Anterior margins of the ventral fins somewhat nearer the extremity of the snout than the base of the caudal. The lateral line is nearly concurrent with the ventral outline. The numbers of the fin-rays are: D. 10; P. 16; V. 8; A. 9; C. $28\frac{3}{3}$." (*Abbott.*) Dull violet above, pinkish below. Kansas River; Platte River. (We have some time since examined specimens from Platte River, and thought them distinct from *G. robusta* and *G. grahami*, but having lost our notes are unable to add to Dr. Abbott's account.)

(Abbott, Proc. Acad. Nat. Sci. Phila. 1860, 474.)

363. G. gracilis Baird & Girard.

Body slender, the back not much elevated, the caudal peduncle not very slender, about twice as long as deep. Head large, its upper profile not very strongly concave. Mouth large, terminal and oblique, the upper jaw scarcely longer than the lower, maxillary reaching past the front of the eye. Interorbital space broad. Pectorals falling considerably short of ventrals. Caudal deeply forked. Dorsal well behind ventrals. Head $3\frac{1}{2}$; depth $4\frac{1}{2}$. D. 9; A. 9; Lat. l. 88. Gila and Colorado Rivers.

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 369; Girard, U. S. Pac. R. R. Surv. x, 287: *Leuciscus zunnensis* Günther, vii, 241.)

** Head conical, scarcely depressed, the profile not concave.

a. Belly scaled.

364. G. emorii Baird & Girard.

Body slender, the back not notably arched. Caudal peduncle very slender, its least depth about one-fifth its length. Head rather small, conic, scarcely depressed above the eyes, its profile continuous with that

of the back. Mouth small, nearly terminal, the maxillary not reaching to the front of the orbit. Eye rather large, anterior, not placed low. Scales small, especially on the back and belly, the exposed surfaces longer than deep. Fins large; the pectorals reaching ventrals; the caudal deeply forked. Dorsal fin inserted nearer the top of snout than to the base of caudal. Head $4\frac{1}{8}$; depth $4\frac{1}{2}$. D. 9; A. 9; Lat. l. 98. Rio Gila. (*Girard.*)

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 388; Girard, U. S. Mex. Bound. Surv. Ichth. 62: *Leuciscus emorii* Günther, vii, 242.)

365. G. nacrea Cope.

Body rather slender; profile and interorbital region gently convex. Maxillary not reaching line of orbit. Caudal peduncle slender, its least depth 4 in head. Eye 5 in head. Pectorals not reaching ventrals. Dorsal behind ventrals. Silvery white; back narrowly dark-shaded; pectoral fins pink. Head 4; depth $4\frac{3}{5}$. D. 9; A. 10; scales 21–?–13; teeth 2, 5–4, 2. Green River (Rio Colorado). (*Cope.*)

(Cope, Hayden's Geol Surv. Wyom. 1870, 441, 1872.

aa. Belly scaleless.

366. G. semimuda Cope & Yarrow.

Body moderately deep, with slender and tapering caudal peduncle, the least depth of which is about one-third its length. Back little elevated, not arched in front of dorsal. Head small, transversely convex, its profile continuous with that of the back and not concave. Mouth rather small, oblique, terminal, the upper lip opposite the middle of the orbit, the maxillary not reaching the line of the orbit. Eye large, rather anterior, but not very low, its length 4 in head. Fins moderate. Dorsal slightly behind ventrals. Brownish above, lower fins pink. Head 5; depth $5\frac{3}{4}$. D. 10; A. 10; scales 21–98–12; teeth 2, 5–4, 2. L. 6 inches. Rio Virgen, in Utah. (*Cope.*) This species forms a transition to *Squalius* and other normally formed *Cyprinidæ*.

(Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. v, 666, 1876.)

102.—SQUALIUS Bonaparte.

Dace.

(*Telestes* Bonaparte; *Cheonda*, *Tigoma*, *Siboma*, and *Clinostomus* Girard.)

(Bonaparte, Fauna Italica, 1837, ¶ 6: type *Cyprinus leuciscus* L., the European "Dace".)

Body oblong, compressed or robust, covered with moderate or small scales, which are not closely imbricated. Lateral line complete, decurved. Mouth large or small, usually terminal, the lips normal, without barbel. Teeth mostly 2, 5–4, 2, sometimes 2, 5–5, 2, or 1, 5–4, 2,

hooked, with narrow grinding surface or none. (Grinding surface present in *Squalius leuciscus*, obsolete in most of our species.) Anal basis short or somewhat elongate. Dorsal fin posterior, usually behind ventrals. Intestinal canal short. Size generally large. A very large group, one of the largest current genera in ichthyology, represented by numerous species in the rivers of Europe, Asia, and North America. Most of our species have been poorly defined. The majority of Girard's original types have been preserved, and the descriptions here given are mainly taken from them. Much larger series of each form are necessary before the species can be properly discriminated. Individual irregularities in dentition are common in this genus. (From *squalus*, a shark; some early writers on ichthyology having called the typical species *Squalus minor*, for no evident reason.)

The species may be divided as follows:

* Teeth normally without grinding surface.

† Caudal peduncle not very stout, its least depth not two-thirds the length of the head.

‡ Mouth very wide, the lower jaw much projecting beyond upper, the upper lip on the level of the middle of the pupil, and the maxillary reaching to below the pupil; body elongate, compressed; dorsal well backward (CLINOSTOMUS Grd.)..... *elongatus, vandoisulus, estor, funduloides.*

‡‡ Mouth moderate or small, terminal, oblique, the lower jaw little projecting, premaxillary below the level of the pupil, and the maxillary not reaching to the pupil. (TIGOMA Grd.)

a. Anal basis elongate, its rays 10–12.... *hydrophlox, tænia, montanus, humboldti.*

aa. Anal basis short, its rays 8 or 9.

b. Scales in lateral line 50–65.

cruoreus, ardesiacus, pandora, margaritus, gula, pulcher, egregius, lineatus, gracilis, conformis, bicolor, obesus, purpureus.

bb. Scales in lateral line 65–80.

pulchellus, intermedius, aliciæ, copei, niger, conspersus.

†† Caudal peduncle very deep and compressed, its least depth nearly equal to the greatest depth of the head; dorsal over ventrals; scales rather large (SIBOMA Girard)..... *gibbosus.*

** Teeth with evident grinding surface. (SQUALIUS.)

c. Robust species, the depth 3–3½ in length; lateral line less than 60.

rhomaleus, squamatus, atrarius, crassus.

cc. Slender species, the depth 4–4¼ in length; lateral line 60–70 (CHEONDA Grd.)..... *cæruleus, cooperi, nigrescens, modestus.*

* Teeth (normally) without grinding surface (various irregularities often present, so that the character has little value).

† Caudal peduncle not very stout, its least depth not two-thirds the length of the head.

‡ Mouth very wide, the lower jaw much projecting beyond upper, the upper lip on the level of the middle of the pupil, and the maxillary reaching to below the pupil; body elongate, compressed; dorsal well back. (*Clinostomus* Girard.*)

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* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 211: type *Luxilus elongatus* Kirtland (κλίνω, to incline; στόμα, mouth.)

367. S. elongatus (Kirtland) J. & G.—*Red-sided Shiner.*

Body elongate, compressed. Head long, rather pointed. Mouth very large, oblique; the lower jaw notably projecting, with a small knob at the symphysis; upper lip on the level of the pupil; maxillary extending to the middle of the orbit; posterior angle of opercle acute. Eye moderate, nearly 4 in head. Scales very small. Fins short and high, the dorsal somewhat behind ventrals. Lateral line decurved. Color dark bluish; the scales mottled with paler; sides with a broad black band; belly more or less silvery; the front half of the lateral band bright crimson in spring males; the belly and lower fins more or less reddened; a dark vertebral band. Head 4; depth 5. D. 8; A. 9; scales 10–70–5; teeth 2, 4–5, 2. L. 5 inches. Great Lakes and Upper Mississippi Valley, chiefly from Pennsylvania to Minnesota.

(*Luxilus elongatus* Kirtland, Rept. Zoöl. Ohio, 169, and in Bost. Journ. Nat. Hist. iii, 339: *Leuciscus elongatus* Giinther, vii, 245: *Clinostomus elongatus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 212: *Gila elongata* Jordan, 300: *Clinostomus proriger* Cope, Cypr. Penn. 375: *Leuciscus proriger* Giinther, vii, 245: *Gila proriger* Jordan, 300 (may be a different species; sides more compressed and more silvery; Lat. l. 63; teeth 2, 4–5, 1; common, with the other.)

368. S. vandoisulus (Val.) Jor & Gilb.

Body oblong, deep and compressed. Head rather large. Mouth large, oblique, the lower jaw projecting, and the mandible extending to the pupil. Eye moderate, $3\frac{1}{2}$ in head. Lateral line decurved. Color bluish green; some of the scales of the back irregularly darker, producing a mottled appearance; no dark lateral band; males in spring with the region behind the head and above the pectorals as far back as the anal of a bright rose-red, brightest anteriorly. Head $3\frac{2}{3}$; depth $3\frac{2}{3}$. D. 9; A. 8; Lat. l. 53; teeth 2, 5–5, 2. L. 5 inches. Virginia to Georgia; abundant.

(*Leuciscus vandoisulus* Cuv. & Val. xvii, 317: *Clinostomus affinis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 212: *Leuciscus vandoisulus* Giinther, vii, 256: *Leuciscus affinis* Gunther, vii, 257: *Clinostomus affinis* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 228: *Gila vandoisula* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 24.)

369. S. estor Jordan & Brayton.

Body elliptical-elongate, compressed, the caudal peduncle rather long, but not so long as head. Head very long and large, flattish, but not broad above. Mouth larger than in any other of our *Cyprinidæ*, very oblique, the upper jaw on the level of the pupil, the maxillaries extending to opposite the middle of the orbit, the length of the gape a little more than half the length of the head, the lower jaw considerably the longer. Eye rather large, less than snout, 4 in head. Scales mod-

erate. Lateral line strongly decurved; 23 series of scales in front of dorsal fin. Fins high. Color dark olive above, many scales irregularly darker; sides silvery; no dark lateral band; a broad shade of deep rose-color along the sides in spring males, below which most of the belly is bright crimson, these red colors brightest anteriorly. A narrow, dark lateral streak like a pencil-mark, from head to tail, overlaid by the scales. Head $3\frac{2}{3}$; depth $4\frac{1}{4}$. D. 8; A. 8; scales 8–50–5; teeth 2, 5–4, 2. L. 4 inches. Cumberland and Tennessee Rivers.

(*Gila estor* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 66: *Gila estor* Jordan, 300.)

370. S. funduloides (Grd.) Jor. & Gilb.

Body rather elongate, somewhat compressed, with arched back and rather slender caudal peduncle, the latter longer than head. Head moderate, smaller than in any of the preceding species. Mouth as in the preceding, but less deeply cleft. Eye large, 3 in head. Dusky above; a dark lateral band, with a narrower pale streak above it; belly and lower part of head yellowish, red in males in spring. Head $4\frac{1}{4}$; depth $4\frac{1}{4}$. D. 8; A. 8; scales 9–48–4; teeth 2, 5–4, 2. Streams tributary to Chesapeake Bay, south to North Carolina. (*Cope.*)

(*Clinostomus funduloides* and *carolinus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 212: *Clinostomus funduloides* Cope, Cypr. Penn. 376: *Leuciscus funduloides* Günther, vii, 256.)

†† Mouth moderate, terminal, oblique, the lower jaw little projecting, the premaxillary below the level of the pupil, and the maxillary not reaching to pupil. (*Tigoma* Girard.*)

a. Anal basis elongate, its rays 10–12.

371. S. hydrophlox (Cope) Jor. & Gilb.

Body rather slender. Head small; front straight. Mouth rather small, oblique, the maxillary just reaching line of orbit, lower jaw projecting. Eye small, 5 in head, $1\frac{1}{2}$ in interorbital width. Anal fin long. Color olive above, with a dusky lateral border, below this a crimson band, and still lower a blackish band, which runs above the lateral line to the base of the caudal fin; cheeks, sides, and belly crimson anteriorly in males, silvery in females. Head $4\frac{3}{4}$; depth $4\frac{1}{2}$. D. 8; A. 11; scales 15–58–7; teeth 2, 5–4, 2. L. 6 inches. Blackfoot Creek, Idaho. (*Cope.*) A species intermediate between the typical *Clinostomi* and the *Tigomæ*, closely related to *S. montanus*, etc.

(*Clinostomus hydrophlox* Cope, Hayden's Geol. Surv. Mont. 1871, 475, 1872.)

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*Girard, Proc. Acad. Nat. Sci. Phila. 1856, 205: type *Gila puchella* B. & G. (A coined name.)

372. S. tænia (Cope) J. & G.—*Leather-sided Minnow.*

Body rather elongate, but deep and compressed, formed as in *Clinostomus* proper. Head rather small, short, compressed, but broad above, the jaws equal. Mouth oblique, short, the maxillary reaching the front of the orbit, the upper lip opposite middle of orbit. Eye large, $3\frac{1}{5}$ in head, equal to interorbital space. Lateral line decurved; 33 scales in front of the dorsal fin. Coloration greenish silvery; the back dusky; a blackish lateral band, between two silvery stripes; the lateral band and below bright orange, red in the males. Head $4\frac{1}{3}$; depth 4. D. 9; A. 10 or 11; scales 12–58–5. L. 3–5 inches. Salt Lake Basin; abundant in Provo River. Very close to the next, differing in shorter anal and rather deeper body.

(*Clinostomus tænia* Proc. Amer. Phil. Soc. Phila. 1874, 133: *Gila tænia* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 658.)

373. S. montanus (Cope) J. & G.

Body rather slender. Muzzle decurved, obtuse, but less so than in *S. tænia*. Jaws equal; end of maxillary extending beyond margin of orbit. Eye large, $3\frac{1}{2}$ in head, equal to interorbital space. Anal fin elongate. Lateral line decurved. Olive above; a dark lateral band; sides crimson in males. Head 4; depth 4. D. 9; A. 12; scales 12–56–6. L. $3\frac{1}{2}$ inches. Idaho to Arizona; abundant in the Utah Basin, with the preceding.

(*Clinostomus montanus* Cope, Hayden's Geol. Surv. Mont. 1871, 476, and Proc. Acad. Nat. Sci. Phila. 1874, 136: *Gila montana* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 657.)

374. S. humboldti (Grd.) J. & G.

Body short and deep. Head moderate. Mouth terminal, oblique, the cleft rather short, the maxillary reaching front of eye. Eye large, 4 in head. Lateral line little decurved. Dorsal fin rather behind ventrals. Anal fin rather elongate. Color bluish; sides with two dusky lateral bands. Scales large. Head 4; depth 3. D. 8; A. 12; scales 12–56–8; teeth 2, 4–5, 1. Humboldt River, Nevada.

(*Tigoma humboldti* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 206, and U. S. Pac. R. R. Surv. x, 291.)

aa. Anal basis short, its rays 8–9.
b. Scales in lateral line 50–65.

375. S. cruoreus J. & G.

Body moderately elongate, symmetrical, not strongly compressed. Head broad, rounded above, maxillary reaching front of eye. Eye rather large, $4\frac{1}{2}$ in head. Lateral line running low. Dorsal a little behind ventrals, scarcely nearer base of caudal than snout. Caudal

evenly forked. Pectorals short, not reaching nearly to ventrals; ventrals to vent. Dusky bluish; sides dark; a red spot at bases of ventrals and anal. Head 4; depth 4. D. 9; A. 8; scales 11–56–6; teeth 2, 5–4, 2. L. 6 inches. Utah Lake.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 461.)

376. S. ardesiacus (Cope) J. & G.

Body rather stout, compressed. Head heavy, muzzle short. Mouth short, very oblique, the jaws about equal, the maxillary reaching past the front of the large eye. Eye 4 in head. Pectoral fin long, nearly reaching anal. Olivaceous above; a narrow dark lateral band, following the direction of the back. Anal fin short. Head $3\frac{1}{2}$; depth $4\frac{1}{5}$. D. 8; A. 8; scales 17–63–8; teeth 2, 5–4, 2. L. 4 inches. Exact locality unknown; probably Nevada.

(*Gila ardesiaca* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 660.)

377. S. pandora (Cope) J. & G.—*Chub of the Rio Grande; Pescadito.*

Body fusiform. Head small, broad and rather flat at the muzzle. Jaws equal, maxillary not reaching line of orbit. Eye small, $6\frac{1}{4}$ in head. Dorsal fin posterior. Silvery, darker above. A broad, ill-defined lateral band. Physiognomy of *Ceratichthys* rather than of *Squalius*. Head 4; depth $4\frac{1}{5}$. D. 8; A. 8; scales 17–61–9 (17–59–10 to 18–65–11); teeth normally 2, 5–4, 2, sometimes 2, 4–4, 2, or even 1, 4–4, 1, in abnormal or immature specimens; the second tooth sometimes with a small grinding surface. L. 8 inches. Rio Grande region. "The most abundant fish in New Mexico," and quite variable in characters usually very constant among these fishes.

(*Clinostomus pandora* Cope, Hayden's Geol. Surv. Mont. 1871, 475.)

378. S. margaritus (Cope) J. & G.

Body stout and thick, little compressed, the back somewhat elevated. Caudal peduncle thick. Head blunt, thick and rounded. Mouth small, terminal, oblique, the upper lip below the orbit, the maxillary not reaching the line of the orbit. Eye rather large. Scales rather small. Lateral line decurved. Fins rather large. Dorsal fin posterior. Coloration above dusky olive; sides plumbeous silvery; belly white, crimson in spring males; snout dusky; fins plain; scales punctate. Head 4; depth 4. D. 8; A. 8; scales 11–58–8; teeth 2, 5–4, 2. L. 3 inches. Susquehanna River. A handsome fish, quite unlike any other American species, resembling most *Phoxinus neogæus*.

(*Clinostomus margarita* Cope, Cypr. Penn. 1866, 377: *Leuciscus margarita* Günther, vii, 246.)

379. S. gula (Cope) J. & G.

Body rather robust, heavy anteriorly. Head large, with wide front and broad, oblique mouth; maxillary reaching front of eye. Eye 5 in head, 2 in interorbital width. Dorsal fin posterior. Color dusky above; belly silvery; axils of fins crimson in males. Head $3\frac{1}{2}$; depth $4\frac{2}{3}$. D. 8; A. 8; scales 16–60–11; teeth 2, 5–4, 2. L. 7 inches. New Mexico. (*Cope.*)

(*Gila gula* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 661.)

380. S. pulcher (Grd.) Jor. & Gilb.

Body rather slender, little compressed. Head rather long and pointed. Mouth oblique, terminal, the jaws about equal, the maxillary barely reaching the front of eye. Scales moderate. Lateral line decurved. Fins large. Dorsal behind ventrals, its tip when depressed reaching the posterior base of the anal. Pectorals nearly reaching ventrals. Coloration brilliant; dusky above; sides and belly golden (red in life?); sides with a vague dusky band. Head $3\frac{4}{5}$; depth $4\frac{1}{3}$. D. 8; A. 8; scales 13–63–7; teeth 1, 4–4, 1, without grinding surface. L. 6 inches. Chihuahua River. A handsome species, resembling *Squalius cæruleus*, but with the fins larger and the number of teeth different. Although Girard places this fish among the *Tigomæ* with grinding surface on the teeth, we are unable to find such surface on his typical specimens. All that we have examined have the teeth sharp, and 1, 4–4, 1. If this dentition is constant, it may be necessary to refer *S. pulcher* to a different genus.

(*Tigoma pulchra* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 207, and U. S. Mex. Bound. Surv. Ichth. 65.)

381. S. egregius (Grd.) J. & G.

Body rather elongate, subfusiform. Head moderate. Snout thickish, subconical. Mouth oblique, the jaws equal, the maxillary reaching front of orbit. Eye moderate, $4\frac{1}{2}$ in head. Lateral line not much decurved. Color bluish black; sides with two irregular bands of dark spots; the interspace red in males. Head 4; depth 4. D. 8; A. 9; Lat. l. 65. Great Basin; exact locality unknown.

(*Tigoma egregia* Grd. U. S. Pac. R. R. Surv. x, 291.)

382. S. lineatus (Grd.) J. & G.

Body elongate, subfusiform. Head moderate. Snout subconical. Mouth oblique, lower jaw somewhat included, maxillary reaching to orbit. Dorsal fin posterior. Scales small. Lateral line with an open

curve, running unusually low. Yellowish; above dusky, with darker spots and narrow dark lines. Head $4\frac{1}{4}$. D. 8; A. 8. Utah Basin; exact locality not known. (*Girard.*)

(*Tigoma lineata* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 206, and U. S. Pac. R. R. Surv. x, 292.)

383. S. gracilis (Grd.) J. & G.

Described as still slenderer and with still smaller scales than in *S. lineatus*. Lateral line little decurved. Snout subconical, rather short. Coloration plain, dusky above, paler below. D. 8; A. 7. Exact locality unknown; probably from Utah. (*Girard.*)

(*Tigoma gracilis* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 206.)

384. S. conformis (B. & G.) J. & G.

Body robust, rather elevated. Head moderate, the mouth rather small, oblique, maxillary not quite reaching eye. Eye moderate, nearly 5 in head. Dorsal fin considerably behind ventrals. Scales large. Lateral line decurved. Purplish brown above, yellowish below. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. 8; A. 8; scales 9–52–5; teeth 2, 4–?, ?. L. 4 inches. Tulare Valley, California.

(*Lavinia conformis* B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 137: *Tigoma conformis* Grd. U. S. Pac. R. R. Surv. x, 289.)

385. S. bicolor (Girard) J. & G.

Body robust, heavy anteriorly, tapering backward. Head long. Mouth large, the maxillary reaching to the eye. Eye small, 6 in head. Scales rather large. Lateral line decurved. Dorsal fin inserted almost directly over ventrals. Fins rather small. Dusky above, sides and below silvery. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. D. 8; A. 8; scales 13–64–6; teeth 2, 5–5, 2. L. 12 inches. Klamath Lake, Oregon.

(*Tigoma bicolor* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 206, and U. S. Pac. R. R. Surv. x, 289.)

386. S. obesus (Grd.) J. & G.

Body short and compact, the caudal peduncle rather slender. Head small, the snout short and rounded. Mouth moderate, maxillary reaching to eye. Eye moderate, $4\frac{1}{4}$ in head. Dorsal fin smaller than anal, nearly median. Scales moderate. Lateral line little deflected. Bluish gray above, yellowish below. Head $4\frac{1}{4}$. D. 8; A. 9. Salt Lake Valley. (*Girard.*)

(*Tigoma obesa* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 206, and U. S. Pac. R. R. Surv. x, 290.)

387. S. purpureus (Grd.) Jor.

Stout and compressed. Head long. Lateral line decurved. Dorsal fin slightly behind ventrals. Fins all small. Blackish above, pale below. Head $3\frac{1}{3}$; depth $3\frac{3}{4}$. A. 8; scales 13–62–8; teeth 2, 4–?, ?. San Bernardino, Mexico.

(*Tigoma purpurea* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 206.)

bb. Scales in lateral line 65–80.

388. S. pulchellus (B. & G.) J. & G.

Body long and slender, the caudal peduncle rather narrow, but not specially contracted. Head slender, rather pointed. Mouth moderate, somewhat obliique, the maxillary scarcely reaching to the eye. Lateral line strongly decurved. Fins high, the dorsal somewhat behind ventrals. Eye $4\frac{1}{2}$ in head. Grayish; two dusky lateral streaks; belly white. Head 4; depth $4\frac{1}{4}$. D. 8; A. 8; Lat. l. 66; teeth 2, 5–4, 2. Rio Mimbres, a tributary of Lake Guzman, in Mexico.

(*Tigoma pulchella* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 29: *Tigoma pulchella* Grd. U. S. Mex. Bound. Surv. Ichth. 62.)

389. S. intermedius (Grd.) J. & G.

"Intermediate between *S. pulchellus* and *S. purpureus*, much nearer the former than the latter." Similar to the preceding. The caudal peduncle slender. Dorsal fin somewhat behind ventrals. Fins small. Coloration silvery, with dark dots. Head $3\frac{3}{4}$; depth 4. D. 8; A. 9; scales 15–73–9. Rio Gila.

(*Tigoma intermedia* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 206.)

390. S. aliciæ Jouy.

Body elongate, little compressed, the dorsal and ventral outlines similar. Head short, rather stout, its breadth $\frac{3}{5}$ its length. Snout rounded, jaws equal, the maxillaries reaching front of eye. Eye 4 in head. Pectoral fin as long as head, not reaching ventrals. Dark plumbeous above, with a median steel-blue lateral band; belly pinkish; cheeks silvery. Head $4\frac{1}{3}$; depth $4\frac{1}{3}$. D. 8; A. 8; scales minute, 18–80–15. Utah Lake.

(Jouy, Proc. U. S. Nat. Mus. 1881, x.)

391. S. copei Jordan & Gilbert.

Body comparatively elongate and compressed, the caudal peduncle long and rather slender. Head short, rather broad and flattish above, the interorbital space convex and broader than the eye. Eye moderate, as long as snout, $3\frac{1}{2}$–4 in head. Mouth rather small, low, terminal, ob-

lique, the premaxillary just below the level of the pupil, the maxillary reaching to just below the level of the eye. Dorsal fin inserted somewhat behind ventrals. Pectorals short, not reaching nearly to ventrals, the latter not to the vent. Scales very small. Lateral line somewhat decurved. Bluish olive above, with dark points; a dusky lateral shade; fins nearly plain; axils red in the males. Head $4\frac{1}{4}$; depth $3\frac{3}{4}$. D. 8; A. 8; scales about 19–80–12; teeth 2, 5–4, 2, typically without grinding surface, but subject to an unusual amount of irregularity, occasionally 2, 4–4, 1 or 2, and sometimes with grinding surface. L. 6 inches. Rio Grande and basin of Utah; very abundant. Described from specimens from Bear River, Wyoming.

(*Gila egregia* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 662 (not *Tigoma egregia* Girard, as Girard's original specimens have Lat. l. 65); Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 461.)

392. S. niger (Cope) J. & G.

Body robust, the back elevated anteriorly, the caudal peduncle shortish and not very stout. Occiput depressed. Head large. Eye rather large, 5 in head. Mouth large, moderately oblique, the lower jaw included, the maxillary extending to the pupil. Fins small, the dorsal well backward. Scales small, posteriorly smaller and more crowded. Lateral line little decurved. Color dusky, the scales with black dots. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. D. 8; A. 8; Lat. l. 80; teeth 2, 4–5, 2, said by Girard to have a developed grinding surface, which, however, we are unable to find. Rio Gila. A well-marked species, approaching the genus *Gila*.

(*Gila gibbosa* B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 28: *Tigoma gibbosa* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 207, and U. S. Mex. Bound. Surv. Ichth. 64: *? Gila nigra* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 663. The name *gibbosa* is, unfortunately, preoccupied.)

393. S. conspersus (Garm.) J. & G.

Form of *S. niger*. Profile of head concave, maxillary reaching front of orbit. Pectorals extending three-fourths distance to ventrals, which reach vent. Brown above; scales of back and sides speckled with darker; an obscure dusky lateral shade. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. D. 8; A. 8; "teeth 4, 1–1, 4, clawed"; scales 13–69–9. Nazas River. (*Garman.*)

(*Gila conspersa* Garman, Bull. Mus. Comp. Zoöl. viii, 1881, 91.)

†† Caudal peduncle very deep and compressed, its depth nearly equal to the depth of the head; dorsal over ventrals; scales rather large. (*Siboma* Girard.)

394. S. gibbosus (Grd.) J. & G.—*Mullet; Chub.*

Body short, deep, compressed, the antedorsal region arched, the caudal peduncle nearly as deep as long, about as deep as the head.

Head conic, the profile steep, the muzzle short and rather pointed. Mouth small, oblique, the jaws nearly equal, the upper lip on the level of the lower part of the pupil, the maxillary scarcely reaching to front of eye; isthmus very narrow; preorbital nearly as deep as long. Eye small, anterior, 5 in head. Fins low. Dorsal fin opposite ventrals, nearer caudal than snout; caudal fin short, little forked, scarcely broader than the very deep caudal peduncle, the spines of the caudal vertebræ very strong. Scales large, rather closely imbricated, their exposed surfaces rather deeper than long; 26 scales before dorsal. Lateral line decurved. Color brownish; sides white; young spotted above; scales everywhere with dark dots; fins plain. Head $4\frac{1}{8}$; depth 3. D. 8; A. 8; scales 9–56–7; teeth 2, 5–4, 2. L. 12 inches. Rivers of California; very abundant. One of the most peculiar of our *Cyprinidæ*, but hardly constituting a distinct genus.

(*Lavinia crassicauda* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 137 (August): *Siboma crassicauda* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 208, and U. S. Pac. R. R. Surv. Fish. 296: *Leuciscus crassicauda* Günther, vii, 243: *Leuciscus gibbosus* Ayres, Daily Placer Times and Transcript, May 30, 1854: *Lavinia gibbosa* Ayres, Proc. Cal. Acad. Sci. 1854, 20.)

** Teeth with evident grinding surface.* (*Squalius.*)

c. Robust species; depth 3 to $3\frac{1}{2}$ in length; lateral line less than 60.

395. S. rhomaleus Jor. & Gilb.

Body very robust, elevated anteriorly, the sides compressed, although the back is very broad. Head broad, the profile concave as seen from the side, the interorbital space flattish, scarcely raised above the eye. Snout broad, elevated at tip, premaxillary on the level of pupil. Mouth very oblique, the mandible much projecting, maxillary reaching front of eye. Eye small, anterior, $1\frac{3}{4}$ in snout, 7 in head; isthmus very narrow. Scales large, subequal, broadly exposed, firm. Lateral line decurved. Dorsal nearly median, inserted directly over ventrals. Caudal evenly forked, the peduncle long and deep. Pectorals short, extending three-fifths the distance to ventrals, ventrals about to vent. Lower fins short. Color blackish; everywhere dark. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. 9; A. 8; scales 10–55–5; teeth 2, 5–4, 2, short and stout, one of them with grinding surface. L. 12 inches. Utah Lake. One of the largest and best marked species.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 461.)

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* A variable character in this group.

396. S. squamatus (Gill) J. & G.

Body very robust, subovate, compressed. Head large and long, conical. Mouth rather large, oblique, terminal, the maxillary reaching front of orbit, the upper lip on the level of the lower part of the eye. Eye moderate, anterior, $5\frac{2}{3}$ in head. Dorsal fin small, inserted posteriorly, but directly over the ventrals. Scales moderate, suborbicular, widely exposed. Color dark or blackish; the scales all margined with black; fins dusky. Head $3\frac{1}{3}$; depth 3. D. 8; A. 8; scales 10–53–6; teeth 2, 5–4, 2. L. 8 inches. Salt Lake Basin.

(*Tigoma squamata* Gill, Proc. Bost. Soc. Nat. Hist. 1861, and Ichth. Capt. Simpson's Expl. 1876, 405.)

397. S. atrarius (Grd.) Jor. & Gilb.—*Utah Mullet; Chub of Utah Lake.*

Body rather stout, the caudal peduncle not slender. Head moderate, subconical. Mouth anterior, quite small, the maxillary not reaching to the eye. Eye small, $5\frac{1}{2}$ in head. Fins quite small. Dorsal fin nearly or quite over the ventrals. Scales large, not much imbricated, 25 before dorsal. Lateral line decurved. Olivaceous, blackish above, the color formed of small black points. Head 4; depth $3\frac{4}{5}$. D. 9; A. 8; scales 11–57–6; teeth 2, 5–4, 2, usually with evident grinding surface, although placed by Girard and Cope in *Siboma*, which wants such surface. L. 20 inches. Utah Basin. Very common in Utah Lake. A large species, used as food, and very destructive to young trout.

(*Siboma atraria* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 208, and U. S. Pac. R. R. Surv. x, 297: *Siboma atraria* and var. *longiceps* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 667.)

398. S. crassus (Grd.) Jor. & Gilb.

Body robust. Head rather small, the snout short and depressed. Mouth moderate, oblique, the maxillary not reaching to the eye. Eye small, 6 in head. Dorsal fin inserted slightly behind ventrals. Scales moderate, broadly exposed. Dusky above, sides and below paler. Head 4; depth $3\frac{1}{2}$. D. 8; A. 8; scales 10–57–7; teeth 2, 5–4, 2, with narrow grinding surface. L. 10 inches. Sacramento River, California.

(*Tigoma crassa* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 207, and U. S. Pac. R. R. Surv. x, 293.)

cc. Slender species, the depth 4–$4\frac{1}{4}$ in length; lateral line 60–70. (*Cheonda** Grd.)

399. S. cœruleus (Grd.) Jor. & Gilb.

Body slender, subfusiform. Head slender, the snout long, conical,

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* *Cheonda* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 207: type *Cheonda cooperi* Grd. (A coined name.)

rather flattened above. Jaws equal, the maxillary reaching to orbit. Dorsal fin inserted behind ventrals. Anal fin quite small. Scales rather small. Dusky bluish above, pale below; scales everywhere with fine punctulations. Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. D. 9; A. 7; scales 13–61–7; teeth 2, 5–5, 2, with narrow grinding surface. Lost River, Oregon.

(*Cheonda cærulea* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 207, and U. S. Pac. R. R. Surv. Fish. 295.)

400. S. cooperi (Grd.) Jor. & Gilb.

Body elongate, subfusiform. Head moderate, the snout thickish, subconical, slightly projecting. Mouth oblique, the maxillary not quite reaching to the eye. Eye large, $4\frac{1}{2}$ in head. Fins large, the anal notably so. Dorsal somewhat behind ventrals. Coloration plain, rather pale. Head $4\frac{1}{3}$; depth $4\frac{1}{4}$. D. 8; A. 10; Lat. l. 63. Columbia River.

(*Cheonda cooperi* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 207, and U. S. Pac. R. R. Surv. Fish. 294: *Leuciscus cooperi* Günther, vii, 243.)

401. S. nigrescens (Grd.) Jor. & Gilb.

Body rather elongate, subfusiform. Head long and rather pointed. Caudal peduncle long. Mouth terminal, oblique, the maxillary scarcely reaching to eye. Snout prickly in male specimens. Fins moderate, the dorsal slightly behind ventrals. Color very dark, the sides with black spots, the scales with fine punctulations. Head $3\frac{1}{2}$; depth 4. D. 8; A. 7; scales 16–70–10; teeth 2, 4 (–5, 2 ?). Boca Grande and Janos River.

(*Tigoma nigrescens* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 207, and U. S. Mex. Bound. Surv. Ichth. 64.)

402. S. modestus (Garm.) J. & G.

Brownish, paler below; flanks not lustrous as in *S. nigrescens*. Form moderately stout, the outlines regular. Dorsal behind ventrals, its free border convex. Anal truncate. Distinguished from *S. nigrescens* by the greater length and the shape of the head, and a difference in the position of the dorsal. Head $3\frac{1}{2}$; depth $3\frac{3}{4}$. D. 8; A. 8; scales 14–65–9. Saltillo, Coahuila.

(*Cheonda modesta* Garman, Bull. Mus. Comp. Zoöl. viii, 92, 1881.)

103.—PHOXINUS Agassiz.

Minnows.

(Agassiz, Mém. Soc. Nat. Hist. Neufchâtel, i, 37, 1837: type *Cyprinus phoxinus* L. = *Phoxinus lævis* Ag.; the common "Minnow" of Europe.)

Body stout. Mouth normal, without barbel. Teeth 2, 5–5, 2, or 2, 5–4, 2, hooked, without grinding surface. Scales usually small, little

imbricated. Lateral line incomplete or wanting. Dorsal fin behind ventrals. Anal basis short. Species of small size and brilliant coloration; found both in Europe and America. (φοξῖνος, a minnow; from φοξός, tapering.)

* Scales very small, 75–90 in the lateral line.

403. P. neogæus Cope.

Body short and thick, little compressed, the back little elevated. Head very large and broad, the muzzle blunt. Mouth moderate, quite oblique, the lower jaw projecting; maxillary reaching to beyond front of orbit; upper lip on the level of the middle of the pupil. Fins moderate. Dorsal well backward, much nearer caudal than snout, somewhat behind ventrals. Pectorals large. Scales very small, almost imbedded in the skin. Lateral line decurved, very short, not extending to ventrals. Back and belly scaly. Eye large, $3\frac{1}{2}$ in head. Color very dark; back plain, almost black; a black band through snout and eye to caudal; above this a pale band; below this abruptly white; belly and lower fins crimson in spring males; pectorals dusky. Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. D. 8; A. 8; scales 18–80–11; teeth 2, 4–5, 2. L. 3 inches. Michigan to Iowa; not common.

(Cope, Cypr. Penn. 1866, 375; Günther, vii, 247.)

** Scales moderate, 40–45 in the lateral line.

404. P. flammeus Jordan & Gilbert.

Body moderately stout, slenderer and more compressed than in *P. neogæus*. Head rather short and deep, the upper outline rounded, the muzzle rather blunt. Eye large, $3\frac{1}{3}$ in head. Mouth small, oblique, the jaws about equal, the upper lip on the level of the pupil, the maxillary extending to the front of the orbit. Scales much larger and more loosely imbricated than in the other species. Back and belly scaled. Lateral line short, decurved, on 14 scales, not reaching base of ventrals. Fins small, the dorsal well backward. Back dark; a black lateral band, formed of dark specks; above this a pale band; the belly below this pale; bright scarlet red in the males in spring. Head 4; depth 4. D. 8; A. 8; scales 7–43–5; teeth 2, 4–5, 2. L. $2\frac{1}{2}$ inches. Tennessee River.

(Jordan & Gilbert, Man. Vert. E. U. S. ed. 2, 1878, 303; Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 66.)

405. P. milnerianus Cope.

"Form elongate, chin slightly beyond upper lip. Pharyngeal teeth 2, 5–4, 2. Scales in 15 longitudinal rows between the dorsal and ven-

tral fins. Diameter of orbit equal to length of muzzle, and entering length of head 3½ times. The latter enters the length to origin of the caudal fin 4 times. The greatest depth enters the same 5½ times. The dorsal fin originates above a point behind the entire base of the ventrals. Radii: D. I, 8; A. I, 8. The mouth is rather large, the extremity of the maxillary bone extending nearly to the line of the pupil of the eye. The head is rather flat above and wide, the parietal width being about one-third the length between the last dorsal ray and the base of the caudal. The distance to which the lateral line extends is unknown, because the scales of the posterior part of the body are lost. Color brownish olive above, below silvery; a black band, not well defined on the borders, extends from the end of the muzzle to the base of the caudal fin, where it terminates in a black spot; a reddish spot at the base of the anterior dorsal rays; muzzle dark." (*Cope.*) L. 2½ inches. Upper Missouri River. "This species differs from *P. neogæus* in its slender form and the small number of rows of scales."

(Cope, Amer. Nat. July, 1879, 440.)

***Scales large, 35–40 in the lateral line.

406. P. phlegethontis (Cope) Jor. & Gilb.

Body short and deep. Mouth very oblique, the jaws even, the maxillary reaching front of the eye, which is rather large. Dorsal behind ventrals. Lateral line entirely wanting (in the typical examples; probably more or less developed in the adult, perhaps complete, in which case the species is a *Telestes*). Olivaceous; a broad plumbeous lateral band; a dusky dorsal line; belly golden. Head 4; depth 3½. D. 7; A. 8; scales 11–37; teeth 1, 5–4, 2. L. 1½ inches. Beaver River, Utah. (*Cope.*)

(*Clinostomus phlegethontis* Cope, Proc. Amer. Phil. Soc. Phila. 1874, 137: *Gila phlegethontis* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 657.)

104.—LEUCUS Heckel.

Roaches.

(*Myloleucus* Cope; *?Algansea* Girard; not *Lencus* Kaup, 1824, a nominal genus of *Laridæ*, the word *Lencus* being a misprint for *Leucus*.)

(*Leucos* Heckel, Russeggers' Reisen, i, 1038, 1843: type *Leucos cisalpinus* Heckel.)

Body stout, compressed. Mouth normal, oblique; no barbel. Teeth 4–5* or 5–5, hooked, with narrow grinding surface, the lower usually on

* Teeth 4–4 in the type of *Leucus tincella*.

a prominent raised prominence of the bone. Scales moderate. Lateral line continuous, decurved. Anal basis short. Abdomen not compressed. Intestinal canal not elongate. Species numerous in Europe, Asia, and America. This genus is very closely allied to the European *Leuciscus* Cuvier, differing in the presence of teeth 5–5 or 5–4, instead of 6–5 or 6–6. The name finally to be adopted for this group, if admitted as distinct, is uncertain. (λευκος, white.)

a. Teeth 4–4,* with entire edges. (*Algansea* Girard.†)

407. L. tincella (Val.) J. & G.

Body stoutish. Head heavy. Mouth moderate, oblique, the maxillary not reaching to the eye. Jaws about equal. Eye rather small. Caudal peduncle thick. Fins small, the caudal short. Dorsal just over ventrals. Scales quite small, firmly attached and not closely imbricated, as in *Mylochilus*, etc. Coloration dark, plain; fins unspotted. Head $3\frac{3}{4}$; depth $3\frac{3}{5}$; scales 17–70–9; teeth 4–4. L. 6 inches. City of Mexico.

(*Leuciscus tincella* C. & V. xvii, 323; Günther, vii, 244.)

aa. Teeth 4–5, with entire edges. (*Myloleucus* Cope.‡)

408. L. obesus (Grd.) Jor.

Body stout. Head short, the muzzle not decurved. Mouth small, oblique, terminal, the lower jaw somewhat projecting, maxillary nearly reaching to orbit. Eye $4\frac{1}{5}$ in head; preorbital deeper than long. Color dark; the belly silvery; the scales everywhere dusted with black specks; a dusky lateral band. Head $3\frac{3}{4}$; depth $3\frac{1}{3}$. D. 9; A. 8; scales 12–58–7 (13–58–9, *Cope*); teeth 5–4. L. 6 inches. Utah Basin; abundant.

(*Algansea obesa* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 183, and U. S. Pac. R. R. Surv. Fish. 239: *Leuciscus obesus* Günther, vii, 244: *Myloleucus pulverulentus* Cope, Hayden's Geol. Surv. Mont. 1871, 475, 1872; Jordan & Henshaw, Rept. Chief Eng. 1878, App. NN. 192.)

409. L. formosus (Grd.) Jor.

Very close to the next, and perhaps identical with it. Body a little more slender, the scales smaller, and profusely dotted with black as in *L. obesus*. Head $3\frac{3}{4}$; depth 4. D. 8; A. 8; scales 10–53–6; teeth 5–4. L. 4 inches. California.

(*Algansea formosa* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 183: *Leuciscus formosus* Günther, vii, 245; Jordan & Henshaw, l. c. 193.)

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* In specimens examined; the normal number is probably 5–4. If permanently 4-4, *Algansea* may be regarded as a distinct genus.

† Girard, Proc. Acad. Nat. Sci. Phila. 1856, 184: type *Leuciscus tincella* Val. (A coined name.)

‡ Cope, Hayden's Geol. Surv. Mont. 1871, 475, 1872: type *Myloleucus pulverulentus* Cope = *Algansea obesa* Girard. (μύλος, grinder; λευκός, Leucus.)

410. L. bicolor (Grd.) Jor.

Body moderately stout. Head rather heavy, the muzzle very short and conical. Mouth moderate, very oblique, the jaws equal, the maxillary reaching line of eye. Scales rather large. Lateral line decurved. Eye rather large, 4½ in head. Color transparent, olivaceous; a distinct plumbeous lateral band. Fins dusky-shaded. Scales with some brown dots, but not profusely dusted with black specks as in the two preceding species. Head 3¾; depth 3¾. D. 8; A. 7; scales 8–50–5 (11–48–5, *Cope*); teeth 4–5. L. 5 inches. Steams of Oregon, Nevada, etc.

(*Algansea bicolor* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 183: *Leuciscus bicolor* Günther, vii, 245: *Myloleucus parovanus* Cope, Zoöl. Wheeler's Expl. W. 100th Mer. v, 669; Jordan & Henshaw, l. c. 193.)

411. L. anticus (Cope) Jor. & Gilb.

"Nearest to the *formosus* of Girard, but differs in the much more posterior position of the fins. In this the anterior base of the dorsal is equidistant between end of muzzle and base of tail; in *anticus* much behind the median point. The ventrals are much nearer the caudal than the chin; in the *formosus* the reverse is the case." Body moderate, shortened behind. Caudal peduncle short, thick. Caudal fin short, little forked. Mouth oblique, muzzle not reaching line of orbit. Eye 5 in head. Profile long, flat, descending; dorsal outline arched. Purplish slate above, yellow below; sides of head and edges of scales punctulate. Head 3⅞. D. 8; A. 8; scales 10–50–6; teeth not described. L. 5 inches. Texas. (*Cope.*)

(*Algansea antica* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 282.)

412. L. boucardi (Günther) Jor. & Gilb.

Body moderately elongate. Head thick, obtuse. Mouth broad, its cleft not extending to the eye. Snout convex, the lower jaw included. Eye moderate, 4½ in head. Caudal fin moderately forked. Origin of dorsal fin close behind that of the ventrals. Brownish; a bluish lateral band, forming a faint caudal spot. Head 4; depth 4. D. 8; A. 9; scales 6–39–4; teeth 5–4. L. 3½ inches. Cuernavaca, Mexico. (*Günther.*)

(*Leuciscus boucardi* Günther, vii, 485.)

105.—OPSOPŒODUS Hay.

(Hay, Proc. U. S. Nat. Mus. 1880, 507: type *Opsopœodus emiliæ* Hay.)

Form of *Hybognathus*. Mouth very small, almost vertical, its position entirely anterior, with scarcely any lateral cleft. Teeth 5–5, with grinding surface and serrated edges. Abdomen not compressed. Dorsal

nearly over ventrals. Anal basis short. Lateral line complete. Intestinal canal short. Peritoneum white. Small. (*ὀψοποιέω*, to feed daintily; *ὀδους*, tooth.)

413. O. emiliæ Hay.

Body rather elongate, moderately compressed, not elevated. Head short, slender. Muzzle blunt and rounded. Mouth very small and very oblique, smaller than in any other of our *Cyprinidæ*, with scarcely any lateral cleft; its size, when opened wide, less than that of the eye. Mandible short and deep, strongly curved, jaws equal. Eye longer than snout, 3 in head. Dorsal beginning over posterior rays of ventrals, nearer snout than base of caudal. Pectoral very small, not reaching ventrals, the latter to anal. Caudal peduncle long and slender. Anal short and deep. Breast naked; 16 large scales before dorsal. Yellowish; sides silvery; scales above dark-edged; a dark lateral band from snout to caudal, above and below which are series of black dots; anterior rays of dorsal dark; sometimes a black spot on the posterior rays. D. 9; A. 8; scales 5–40-3; teeth 5–5, serrate. Eastern Mississippi.

(Hay, Proc. U. S. Nat. Mus. 1880, 507.)

106.—TRYCHERODON Forbes.

(Forbes, MSS. gen. nov.: type *Trychcrodon megalops* Forbes.)

Pharyngeal teeth in one row, 5–5 or 5–6, strongly hooked, deeply crenate, without masticatory surface. Lateral line imperfect. Dorsal over ventrals. Intestine shorter than head and body. Peritoneum pale. Thorax naked almost to ventrals. Mouth terminal, upper jaw protractile. No barbels. (*τρυχερὰς*, ragged; *ὀδων*, tooth.)

414. T. megalops Forbes, spec. nov.

"A small, fusiform species, with a small, terminal, oblique mouth, a very large eye, an imperfect lateral line, a narrow black lateral stripe, a partly naked breast, and large fins. The dorsal has a large dusky black blotch on the front rays. The depth is contained from 4 to 5 times in the length without caudal; the head $4\frac{1}{2}$ to 5 times. The eye is longer than the snout, and goes but $2\frac{3}{4}$ times in the head. Its vertical diameter equals the interorbital space. The mandible scarcely reaches a vertical from the anterior border of the nostril, and falls far short of the orbit. The lateral line is variously imperfect; sometimes present only on the first 4 or 5 scales, and sometimes extending, with numerous interruptions, to the middle of the caudal peduncle. It

is slightly decurved when present on the anterior half of the body. The caudal fin is long and very deeply furcate. It is contained $3\frac{1}{2}$–4 times in head and body, and the median rays are about two-fifths the length of the longest. The dorsal is high, its longest ray reaching nearly or quite half the distance from front of dorsal to tail. The front of the fin is a little nearer nose than caudal. The pectorals extend about three-fourths the distance to the ventrals, and the latter nearly or quite attain the vent. D. I, 7 or 8; A. I, 7 or 8; scales 5, 38–40, 4, with 15 or 16 rows before dorsal. The pharyngeal bones are thin, and suddenly and broadly dilated at outer third, this part of the bone being nearly 3 times as wide as the inner, and in shape not unlike a horse's jaw-bone. The odontoid process is unusually distinct and high. The teeth are very slender, strongly hooked, and sharply and irregularly crenate, the edges having a spinose appearance. The scales are crowded, higher than long, and wanting on the anterior half or two-thirds of the breast. Color in alcohol yellowish brown, with a faint silvery lustre on sides. A narrow, black band, about one scale wide, extends around the nose, through the upper half of the eye, to the tail, terminating there in the most highly colored specimens in a narrow vertical bar. The scales above the lateral band are all dark-edged. In all the specimens the dorsal shows a large submedian blotch in front, crossing about 4 rays. In one this blotch is so enlarged as to include the whole anterior half of the fin, except a small space at base, and a second blotch extends similarly across the 3 posterior rays, leaving only a narrow pale vertical stripe between. Length of largest specimen $2\frac{1}{5}$ inches. Several specimens from the Illinois River at Pekin and Peoria, and from Mackinaw Creek." (*Forbes.*)

107.—NOTEMIGONUS Rafinesque.

Golden Shiners.

(*Stilbe* DeKay.)

(Rafinesque, Journ. de Physique, de Chymie et d'Histoire Naturelle, Paris, 1819, 421: type *Notemigonus auratus* Raf. = *Cyprinus chrysoleucus* Mitch.)

Body subelliptical, strongly compressed, both back and belly curved, the curves different; back narrowly compressed; belly behind ventral fins forming a keel, over which the scales do not pass. Tail not keeled. Head small, conic. Mouth small, terminal, oblique, normal, without barbels. Scales rather large. Lateral line continuous, strongly decurved. Dorsal fin inserted behind the ventrals. Anal fin with its base somewhat elongate, of from 9 to 18 rays. Teeth 5–5, hooked, with

grinding surface, the edges of which are more or less crenate. Alimentary canal short, though rather longer than the body. Size rather large. As here understood, *Notemigonus* differs from the European *Abramis* (Bream) only in the much shorter anal fin—from 9 to 20 rays instead of 30 to 40. All its species are American. There is much variation in the length of the anal and in the form of the mouth among the species left in *Abramis*, and a reunion or a different division of the group may be necessary. (νῶτος, back; ἡμί, half; γόνος, angle; the back being almost carinated.)

* Insertion of dorsal midway of body or nearer snout than base of caudal.

† Anal rays 9 or 10.

415. N. gardoneus (C. & V.) Jor.

Body moderately elongate, compressed. Head obtuse. Isthmus small. Mouth small, oblique, the lower jaw included. Eye 4 in head. Dorsal nearly midway of body, little behind ventrals. Olivaceous. Head $5\frac{1}{2}$; depth $3\frac{3}{4}$. D. 10; A. 9; teeth 5–5, with grinding surface and serrated edge. Scales 7–39–3. South Carolina. One specimen known.

(*Leuciscus gardoneus* Cuv. & Val. xvii, 316: *Chondrostoma gardoneum* Cope, Trans. Amer. Phil. Soc. Phila. 1866, 395: *Leuciscus gardoneus* Günther, vii, 258.)

416. N. lucidus (Grd.) Jor.

Body rather elongate, subfusiform. Head moderate. Snout subconical, tapering. Mouth somewhat oblique, larger than in the other species, the maxillary reaching eye. Eye large, $3\frac{1}{2}$ in head. Dorsal nearer tip of snout than caudal. Scales rather large, much deeper than long. Grayish above, yellowish beneath. Head $4\frac{1}{4}$. D. 8; A. 10. Canadian River. (*Girard.*)

(*Luxilus lucidus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 203, and U. S. Pac. R. R. Surv. x, 282.)

†† Anal rays about 13.

417. N. leptosomus (Grd.) Jor.

Body rather elongate, slender, the back elevated. Head small and short, its profile continuous with that of the back. Mouth small, quite oblique, the maxillary not reaching the front of the large eye. Eye $3\frac{1}{2}$ in head. Insertion of dorsal fin about midway between snout and base of caudal. Anal fin high and long. Bluish, silvery below. Head 5; depth $3\frac{3}{4}$. D. 9; A. 13; Lat. l. 55. Texas. (*Girard.*)

(*Luxilus leptosomus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 203, and U. S. Mex. Bound. Surv. Ichth. 60: *Abramis? leptosomus* Günther, vii, 306.)

** Insertion of dorsal nearer base of caudal than snout.

a. Anal rays about 11.

418. N. occidentalis (Baird & Girard) Jordan.

Body moderately elongate. Snout subconical, rather tapering. Mouth oblique, the maxillary not reaching orbit. Eye large, 4 in head. Brownish above; sides silvery; the belly speckled with gray. D. 10; A. 11. Tulare Valley, California. (*Girard.*)

(*Leucosomus occidentalis* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 137: *Luxilus occidentalis* Girard, U. S. Pac. R. R. Surv. x, 280: *Abramis occidentalis* Günther, vii, 305.)

aa. Anal rays about 13 (12–14).

419. N. chrysoleucus (Mitch.) Jor.—*Golden Shiner; Bream.*

Body moderately elongate, strongly compressed. Head short, subconic, compressed, the profile somewhat concave. Mouth small, oblique, the upper lip on the level of the upper part of the pupil, the maxillary not reaching the front of the eye. Eye moderate, about 4 in head. Fins medium. Color clear greenish above; sides silvery, with bright golden reflections; fins yellowish; the tips of the lower fins sometimes orange in spring males. Head $4\frac{1}{2}$; depth 3. D. 8; A. 13; scales 10–51–3; teeth 5–5. L. 12 inches. New England to Dakota and Texas; everywhere abundant in bayous and weedy ponds. One of the most familiar and characteristic of our *Cyprinidæ*.

(*Cyprinus chrysoleucus* Mitch. Rept. Fish. N. Y. 1815, 23: *Abramis versicolor* DeKay, N. Y. Fauna, Fish. 191: *Leucosomus americanus* Storer, Fish. Mass. 283: *Stilbe americana* Cope, Cypr. Penn. 1866, 389: *Leuciscus, Leucosomus, Luxilus, Plargyrus, Stilbe, Stilbius,* or *Abramis americanus* of various authors (not *Cyprinus americanus* L.): *Luxilus seco* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 203: *Abramis americanus* Günther, vii, 305; Jordan, Bull. U. S. Nat. Mus. x, 65.)

a. Anal rays about 16 (15–18).

420. N. americanus (L.) Jor.—*Southern Bream.*

Body moderately elevated, very strongly compressed. Head rather broad and flat between the eyes. Mouth small, quite oblique, the maxillary barely reaching the eye. Eye very large and prominent, anterior, about 3 in head. Dorsal fin short and very high, almost falcate, well back. Anal fin high and long. Scales rather large, the lateral line running very low. Color pale olive, with silvery lustre; lower fins red in the males in spring. Head $4\frac{1}{3}$; depth $3\frac{1}{3}$. D. 8; A. 16; scales 8–43–2; teeth 5–5. L. 12 inches. Rivers of the South Atlantic States; locally abundant.

(*Cyprinus americanus* Linn. Syst. Nat.: *Leuciscus bosci* Cuv. & Val. xvii, 313: *Notemigonus ischanus* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 364; Jordan, Bull. U. S. Nat. Mus. x, 65.)

108.—RICHARDSONIUS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 201: type *Cyprinus balteatus* Rich.)

Body oblong or elevated, strongly compressed. Head rather small. Mouth terminal, oblique, jaws normal; no barbels. Teeth 2, 5–5, 2, or 2, 5–4, 2, hooked, without grinding surface, the edges entire. Gill-rakers very small. Belly compressed behind ventral fins, the scales passing over its edge. Back of tail not keeled. Scales rather small. Lateral line continuous, decurved. Dorsal fin well behind the ventrals. Anal basis elongate. American; closely related to the European genus *Alburnus*. (Dedicated to Sir John Richardson.)

421. R. balteatus (Rich.) Grd.

Body strongly compressed and somewhat elevated. Head small, the snout rather short and conical. Mouth terminal, oblique, the lower jaw slightly projecting beyond the upper. Eye large, $3\frac{1}{2}$ in head. Coloration plain, the sides bright silvery, crimson in males in spring. Anal and caudal large. Dorsal low, much behind ventrals. Base of anal $4\frac{1}{4}$ in length. Head $4\frac{1}{2}$; depth $3\frac{1}{4}$. D. 10; A. 17 or 18; Vert. 40; Lat. l. 13–62–6; teeth 2, 5–4, 2. Columbia River and northward; abundant.

(*Cyprinus* (*Abramis*) *balteatus* Richardson, Fauna Bor.-Amer. iii, 301: *Richardsonius balteatus* Grd. U. S. Pac. R. R. Surv. x, 278: *Abramis balteatus* Günther, vii, 309.)

422. R. lateralis Grd.

Body slenderer and less compressed. Mouth moderate, terminal, oblique, jaws equal. Anal basis $5\frac{1}{3}$ in length. Blackish above; a dark lateral band; the interspace and belly pale; crimson in males in summer. Head $4\frac{1}{3}$; depth $3\frac{3}{4}$–4. D. 10; A. 14; scales 13–55–6; teeth 2, 5–5, 2. Columbia River and streams about Puget Sound.

(*Richardsonius lateralis* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 202, and U. S. Pac. R. R. Surv. Fish. 279: *Abramis lateralis* Günther, vii, 309.)

109.—LEPIDOMEDA Cope.

(Cope, Proc. Amer. Phil. Soc. Phila. 1874, 131: type *Lepidomeda vittata* Cope.)

Body elongate. Mouth terminal, without barbels. Teeth 2, 4–4, 2, hooked, without grinding surface. Scales small. Lateral line complete. Dorsal fin with a strong spine, composed of two, the posterior received into a longitudinal groove of the anterior. Inner border of the ventral fins adherent to the body. Dorsal fin inserted behind the ventrals. Anal basis short. Size small. (λέπιδος, scaly; Meda.)

423. L. vittata Cope.

Body rather stout. Head wide and flat above, slightly depressed behind the eyes. Muzzle obtuse, not prominent. Mouth terminal, oblique. Eye $3\frac{3}{4}$ in head. Scales small, covering the whole body except the space behind the pectorals; 26 series above the lateral line and 56 in front of the dorsal. Preorbital bone trepezoidal. Second dorsal spine as long as the first, and wider. Dorsal rays somewhat enlarged and ossified. Pectoral rays scarcely enlarged. Color silvery; a lead-colored lateral band and a black dorsal band. Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. D. II, 7; A. 9; teeth 2, 4–4, 2. L. $3\frac{1}{2}$ inches. Colorado Chiquito River, Arizona. (*Cope.*)

(Cope, Proc. Amer. Phil. Soc. Phila. 1874, 131, and Zoöl. Wheeler's Expl. W. 100th Mer. v, 642.)

424. L. jarrovii Cope.

Body more elongate. Mouth nearly horizontal, lower jaw somewhat projecting. Eye larger than in *L. vittata*, $3\frac{1}{4}$ in head, the maxillary reaching its anterior border. Spines slender. Scales very small and difficult to detect, 51 series before the dorsal fin. Olivaceous; a median black vertebral band; sides silvery; bases of ventral fins red. Head 4; depth 5. D. II, 7; A. 9; teeth 2, 4–4, 2. L. 3 inches. Colorado Chiquito River, Arizona. (*Cope.*)

(Cope, Proc. Acad. Nat. Sci. Phila. 1874, 133, and Zoöl. Wheeler's Expl. W. 100th Mer. v, 643.)

110.—MEDA Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 191: type *Meda fulgida* Grd.)

Body elongate. Mouth terminal, normal, no barbels. Teeth 1, 4–4, 1, hooked, without grinding surface. Body entirely scaleless. Fins as in *Lepidomeda*. Size small. (*Meda*, a classical feminine name, of no conceivable application to these singular fishes.)

425. M. fulgida Grd.

Body slender, elongate, compressed. Head elongate, subconical, the snout rounded. Mouth large, subterminal, slightly oblique, the lower jaw included, maxillary extending to below orbit. Second dorsal spine highest; dorsal behind ventrals. Coloration silvery. D. II, 7; A. 8; teeth 1, 4–4, 1. Rio Gila. (*Girard.*)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 191; Günther, vii, 263.)

111.—PLAGOPTERUS Cope.

(Cope, Proc. Amer. Phil. Soc. Phila. 1874, 301: type *Plagopterus argentissimus* Cope.)

Body slender. Mouth terminal, a barbel at the extremity of the maxillary. Teeth 2, 5–4, 2, hooked, without grinding surface. Body entirely scaleless. Fins as in *Meda* and *Lepidomeda*. Size small. (πλαγή, wound; πτερόν, fin; in allusion to the armature of the dorsal fin.)

426. P. argentissimus Cope.

Body slender. Head rather broad, the muzzle slightly depressed, overhanging the rather small, horizontal mouth. Lips thin, the maxillary reaching front of eye. Eye moderate, $4\frac{1}{5}$ in head. Dorsal fin entirely behind ventrals, the first spine curved, longer than the second; soft rays of the dorsal thickened and ossified at base; fifth ray of the ventral bound to the abdomen by a membrane for nearly its whole length; pectoral rays osseous at base. Lateral line complete, slightly deflexed. Color clear silvery; dorsal region dusky, with minute black dots. Head 4; depth 6. D. II, 7; A. 10; teeth 2, 5–4, 2. L $2\frac{1}{2}$ inches. San Luis Valley, Western Colorado. (*Cope.*)

(Cope, Proc. Amer. Phil. Soc. Phila. 1874, 130, and Zoöl. Wheeler's Expl. W. 100th Mer. v, 640.)

112.—CARASSIUS Nilsson.

Crucian Carps.

(Nilsson, Prodromus: type *Cyprinus carassius* L. = *Carassius vulgaris* Nilss.)

Body oblong, compressed, and elevated. Mouth terminal, without barbels. Teeth 4–4, molar, but compressed. Scales large. Lateral line continuous. Dorsal fin very long, with the third ray a stout spine, which is serrated behind; anal short, with a similar spine. Ventrals well forward. Large species of the fresh waters of Europe and Asia; often domesticated. (*Carassius*, a latinization of the vernacular names of the European Crucian Carp, *Karass* or *Karausche*.)

427. C. auratus (L.) Bleeker.—*Gold-fish.*

Body stout, covered with large scales. Dorsal and anal fins with the spines strong, coarsely serrated. Coloration olivaceous, usually orange or variegated in domestication. D. II, 18; A. II, 7; Lat. l. 26; teeth 4–4. L. 12 inches. China and Japan; introduced everywhere as an aquarium fish, and now naturalized in many of our eastern streams. The variations are innumerable.

(*Cyprinus auratus* Linnæus, Syst. Nat.; Günther, vii, 32.)

113.—CYPRINUS Linnæus.

Carps.

(Artedi; Linnæus, Syst. Nat.: type *Cyprinus carpio* L.)

Body robust, compressed, resembling that of the Buffalo-fish. Mouth moderate, anterior, with four long barbels. Snout blunt, rounded. Teeth molar, broad and truncate, 1, 1, 3–3, 1, 1. Scales large. Lateral line continuous. Dorsal fin very long, with a stout spine, serrated behind; anal fin short, also with a spine. Large fishes of the fresh waters of Asia; introduced into Europe and America as food-fishes. (κυπρῖνος, the ancient name of the Carp.)

428. C. carpio L.—*Carp.*

Body stout, more or less compressed, heavy anteriorly. General color olivaceous. D. III, 20; A. III, 5; scales 5–38–5; teeth 1, 1, 3–3, 1, 1. L. 18 inches or more. Fresh waters of Central Asia; introduced as a food-fish into Europe and America. In domestication it has run into many varieties, distinguished by differences in form, squamation, and development of the fins.

(Linnæus, Syst. Nat.; Günther, vii, 25.)

Family XXXII.—CHARACINIDÆ.

(*The Characins.*)

Body variously formed, covered with cycloid scales. Head naked. Margin of upper jaw formed mesially by the premaxillaries and laterally by the maxillaries; no barbels; premaxillaries not protractile. Teeth various, often incisor-like, often wanting. Branchiostegals usually 3. Gill-membranes united to the isthmus or not. No pseudobranchiæ. Gills 4, a slit behind the fourth. Lower pharyngeals not truly falciform, but more or less curved, armed with small, sometimes villiform, teeth. Adipose fin usually present (absent in *Erythrininæ*). Pyloric cœca usually numerous. Air-bladder transversely divided into two portions, and communicating with the organ of hearing by means of auditory ossicles, as in the *Cyprinidæ*. Anterior vertebræ coalesced and modified. A very large family of 60 genera and 300 species, inhabiting the fresh waters of South America and Africa, where they take

the place of the *Salmonidæ* and *Cyprinidæ* of the Northern Hemisphere. A single species reaches the United States.

(*Characinidæ* Günther, vii, 278–380.)

* Adipose fin present.

† Dentition complete in both jaws; gill-openings wide, the membranes not attached to the isthmus; nasal openings of each side close together; teeth compressed, notched. (*Tetragonopterinæ.*)

‡ Anal fin elongate (rays 20–50); belly in front of ventrals rounded; premaxillary teeth in a double series; a single series of teeth in lower jaw, with no conical teeth behind it; no canine teeth; gill-rakers setiform.. TETRAGONOPTERUS, 114.

114.—TETRAGONOPTERUS Cuvier.

(*Astyanax* B. & G.; *Pœciluriehthys* Gill.)

(Artedi; Cuvier, Mém. du Mus. iv, 455, 1818: type *Tetragonopterus argenteus* Cuv.)

Body oblong or elevated, compressed, covered with moderate scales. Belly rounded. Cleft of mouth medium. Anterior teeth strong, incisor-like; lateral teeth small. Premaxillary and mandibular teeth subequal in size, with a compressed, notched crown, the former in a double, the latter in a single, series. Maxillary with few teeth. Nostrils of each side close together, separated by a valve only. Lower pharyngeals very slender, curved, approaching the form in *Cyprinidæ*, armed with a single series of slender, hooked teeth. Gill-openings wide, the membranes free from the isthmus and from each other. Gill-rakers setiform. Dorsal fin midway of body, above or just behind ventrals. Anal fin long. Species about 40, in all the warmer parts of America. (τετράγωνος, four-angled; πτερόν, fin or wing; of no special application to this group, the original word used by Klein and Artedi being *Tetragonoptrus.*)

a. Body oblong, moderately elevated, the depth less than half length. (*Astyanax* Baird & Girard.*)

429. T. argentatus (Baird & Girard) J. & G.

Olivaceous; a broad silvery band along sides; a black spot at base of caudal, running up on the fin. Body oblong, compressed. Snout blunt, lower jaw included. Dorsal inserted above ventrals. Pectorals reaching ventrals, the latter to vent. Head 4 in length; depth 3. D. 10; A. 21; scales 6–38–6. Arkansas to Mexico; probably abundant; the northernmost representative of the family.

(*Astyanax argentatus* B. & G. Proc. Acad. Nat. Sci. Phila. vii, 27, 1854: *Astyanax argentatus* Grd. U. S. Mex. Bound. Surv. Ichth. 74; Günther, v, 380.)

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* Baird & Girard, Proc. Acad. Nat. Sci. Phila. vii, 26, 1854: type *Astyanax argentatus* B. & G. (ἀστυάναξ, a son of Hector.)

ORDER M.—ISOSPONDYLI.

(*The Isospondylous Fishes.*)

Parietals present. Symplectic present. No interclavicles. A præcoracoid arch. Anterior vertebræ simple. No auditory ossicles. Pharyngeal bones simple above and below, the lower not falciform. Gills 4, a slit behind the fourth. A very large group, presenting many modifications of structure. (ἴσος, equal; σπόνδυλος, vertebra.)

(*Physostomi* Günther, part.)

ANALYSIS OF FAMILIES OF ISOSPONDYLI.

* Tail diphycercal.

a. Lateral margins of upper jaw formed by the maxillaries.

b. Adipose fin none; no phosphorescent spots; body usually scaly; head naked; throat without barbel.

c. Lateral line present.

d. Gular plate none.

e. Air-bladder none; dorsal posterior, opposite anal and similar to it; mouth small, with small, pointed teeth; deep-sea fishes. ALEPOCEPHALIDÆ, 33.

ee. Air-bladder present; dorsal in front of anal.

f. Mouth small, horizontal; posterior part of tongue and the roof of the mouth covered with coarse, paved teeth ... ALBULIDÆ, 34.

ff. Mouth larger, oblique; teeth all pointed; those on the tongue large. HYODONTIDÆ, 35.

dd. Gular plate present; mouth large; teeth all pointed ..... ELOPIDÆ, 36.

cc. Lateral line obsolete.

g. Mouth terminal, large; maxillary in three parts, mostly broad. CLUPEIDÆ, 37.

gg. Mouth small, inferior; maxillary short and narrow; not in three parts. ..... DOROSOMATIDÆ, 38.

ggg. Mouth very large, subinferior; maxillary very narrow, produced backward ..... ENGRAULIDIDÆ, 39.

bb. Adipose fin present (rarely absent, and the body with phosphorescent spots).

h. Throat with a long barbel; scales very small or wanting; mouth large ..... STOMIATIDÆ, 45.

hh. Throat without barbel.

i. Sides with phosphorescent spots; oviducts present; deep-sea fishes.

j. Pseudobranchiæ none; body scaly ..... CHAULIODONTIDÆ, 44.

jj. Pseudobranchiæ present; body naked .. STERNOPTYCHIDÆ, 43.

ii. Sides without phosphorescent spots; oviducts none. SALMONIDÆ, 46.

aa. Lateral margins of upper jaw, like the anterior margin, formed by the premaxillaries; adipose fin usually present.

k. Premaxillaries short, with villiform teeth; mouth small; bones of head cavernous; scales ctenoid .. PERCOPSIDÆ, 47.

kk. Premaxillaries elongate; mouth large; bones of head not cavernous; scales mostly cycloid.

l. Dorsal short, nearly median; body scaly .. SCOPELIDÆ, 42.

ll. Dorsal short, posterior; body scaly .. PARALEPIDIDÆ, 41.

lll. Dorsal occupying nearly the whole length of the back; body naked ..... ALEPIDOSAURIDÆ, 40.

FAMILY XXXIII.—ALEPOCEPHALIDÆ.

Body oblong, compressed, covered with thin cycloid or keeled scales, or with naked, prickly skin. Head naked. Lateral line developed. No barbels. Mouth moderate or large. Margin of the upper jaw formed by the premaxillaries and the maxillaries, the former being placed along the upper anterior edge of the latter. Teeth feeble. Opercular apparatus complete, its bones thin. No adipose fin. Dorsal fin long and low, posterior, inserted opposite the anal; pectorals short, placed rather high; ventrals usually well back, sometimes wanting. Gill-openings very wide, the membranes free from the isthmus. Pseudobranchiæ present. No gular plate. No air-bladder. Stomach curved, without blind sac. Pyloric cœca in moderate number. Fishes of the deep seas; but one species known until recently. Lately 3 genera and 7 species have been described from the abyssal faunæ of the mid Atlantic and Pacific.

(*Alepocephalidæ* Günther, vii, 477.)

a. Scales cycloid; dorsal and anal subequal, opposite each other; mouth small; jaws nearly even; small teeth in jaws, vomer, and palatines. ALEPOCEPHALUS, 115.

115.—ALEPOCEPHALUS Risso.

(Risso, Mem. Acad. Nat. Sci. Turin, xxv, 270, 1820: type *Alepocephalus rostratus* Risso, from the Mediterranean.)

Body oblong, compressed. Mouth rather small, the snout somewhat prolonged. Jaws nearly equal in front; a series of small teeth in each jaw and on the vomer and palatines. Eye very large. Gill-membranes entirely separate. Branchiostegals 6. Opercular bones thin. Dorsal low and rather long, with a scaly base, opposite and similar to the anal. Pectorals and ventrals rather small. Caudal moderately forked. Scales rather large, thin and cycloid. Deep-sea fishes of the Atlantic and Mediterranean. (*a*, privative; λεπίς, scale; κεφαλή, head.)

430. A. bairdii Goode & Bean.

Uniform indigo-blue, the color extending to the inside of the mouth and the gill-membranes. Body rather elongate. Head moderately compressed, subconical, the lower jaw included. Maxillary extending nearly to below middle of eye. Eye large, as long as snout. Dorsal slightly in advance of anal. Head $4\frac{1}{3}$ in length; depth $5\frac{1}{3}$. D. 22; A. 25; P. 12; V. I, 9; pyloric cœca 15; B. 6; scales 7–65–11. L. 24 inches. Grand Banks; dredged at a depth of 200 fathoms. (*Goode & Bean.*)

(Goode & Bean, Proc. U. S. Nat. Mus. ii, 55, 1879.)

FAMILY XXXIV.—ALBULIDÆ.

(*The Lady-fishes.*)

Body rather elongate, little compressed, covered with rather small, brilliantly silvery scales. Head naked. Snout conic, subquadrangular, shaped like the snout of a pig, and overlapping the small, inferior, horizontal mouth. Maxillary rather strong, short, with a distinct supplemental bone, slipping under the membranous edge of the very broad preorbital. Premaxillaries short, not protractile. Lateral margin of upper jaw formed by the maxillaries. Eye large, median in head, with a bony ridge above it, and almost covered by an annular adipose eyelid. Opercle moderate, firm. Preopercle with a broad, flat, membranaceous edge, which extends backward over the base of the opercle. Pseudobranchiæ present. Gill-rakers short, tubercle-like. Gill-membranes entirely separate, free from isthmus. Branchiostegals about 14. A fold of skin across gill-membranes anteriorly, its posterior free edge crenate. No gular plate. Both jaws, vomer, and palatines with bands of villiform teeth. Broad patches of coarse, blunt, paved teeth on the tongue behind and on the sphenoid and pterygoid bones. Lateral line present. Belly not carinate, flattish, covered with ordinary scales. Dorsal fin moderate, in front of ventrals, its membranes scaly. No adipose fin. Anal very small. Caudal widely forked. Pyloric cœca numerous. A single species known, found in all warm seas.

(*Clupeidæ* group *Albulina* Günther, vii, 468, 469.)

116.—ALBULA Gronovius.

(Gronovius; Bloch & Schneider, Syst. Ichth. 1801, 432: type *Albula conorhynchus* Bloch & Schneider = *Esox vulpes* L.)

Characters of the genus included above. (Latin *albus*, white.)

431. A. vulpes (L.) Goode.—*Lady-fish; Bone-fish.*

Brilliantly silvery; olivaceous above; back and sides with faint streaks along the rows of scales; fins plain; axils dusky. Upper lobe of caudal the longer. A band of peculiar, elongate, membranaceous scales along middle line of back; accessory ventral scale large. Head $3\frac{3}{4}$; depth 4. D. 15; A. 8; scales 9–71–7. L. 18 inches. Cape Cod to Southern California and East Indies; abundant in tropical seas. Not much valued as food, but beautiful and gamy.

(*Esox vulpes* L. Syst. Nat.: *Albula conorhynchus* Günther, vii, 468.)

Family XXXV.—HYODONTIDÆ.

(*The Moon Eyes.*)

Body oblong, compressed, covered with moderate-sized, brilliantly silvery, cycloid scales. Head naked, short, the snout blunt. Mouth moderate, oblique, terminal, the jaws about equal. Premaxillaries not protractile. Maxillary small, slender, without evident supplemental bone, articulated to the end of the premaxillary, and forming the lateral margin of the upper jaw. Dentition very complete. Premaxillary and dentary bones with small, wide-set, cardiform teeth. Maxillaries with feeble teeth. A row of strong teeth around the margin of the tongue, the anterior canine and very strong; between these is a band of short, close-set teeth. Vomer with a long, double series of close-set, small teeth. Similar series on the palatines, sphenoid, and pterygoids. Sides of lower jaw fitting within the upper, so that the dentaries shut against the palatines. Eye very large, the adipose eyelid not much developed. Preorbitals very narrow. Nostrils large, those of each side close together, separated by a flap. Gill-membranes not connected, free from the isthmus, a fold of skin covering their base. No gular plate. Branchiostegals 8–10. Gill-rakers few, short and thick. Pseudobranchiæ obsolete. Lateral line distinct, straight. Belly not serrated. Dorsal fin rather posterior. Anal elongate, low. Ventrals well developed. Caudal strongly forked. No adipose fin. Stomach horseshoe-shaped, without blind sac; one pyloric cœcum. Air-bladder large. No oviducts, the eggs falling into the cavity of the abdomen before exclusion. A single genus, with 3 known species, inhabiting the fresh waters of North America.

(*Hyodontidæ* Günther, vii, 375, 376.)

157.—HYODON Le Sueur.

Moon Eyes.

(*Hiodon* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 334, 1818: type *Hiodon tergisus* Le Sueur.)

Generic characters included above. (ὑοειδής, hyoid; ὀδών, tooth; "hyoid" is the bone shaped like the letter Y, forming the base of the tongue.)

* Belly in front of ventrals strongly carinated; dorsal rays (developed) 9.

432. H. alosoides (Raf.) J. & G.

Body closely compressed, becoming deep in the adult. Eye moderate, smaller than in other species, about 3½ in head, the maxillary

reaching to beyond its middle. Caudal peduncle rather stouter than in *H. tergisus*, and the fin not so deeply forked. Back less arched and snout blunter than in the other species, the mouth larger and more oblique. Pectorals longer and ventrals shorter than in *H. tergisus*, Belly carinated both before and behind ventrals. Bluish; sides silvery. with golden lustre. Head $4\frac{1}{2}$; depth $3\frac{1}{2}$. D. 9; A. 32; scales 6–56–7. Ohio River to the Saskatchawan; common northward.

(*Amphiodon alosoides* Raf. Journ. Phys. Paris, 1819, 421: *Hyodon chrysopsis* Richardson, Fauna Bor.-Amer. iii, 232, 1836: *Hyodon chrysopsis* Jordan, Bull. U. S. Nat. Mus. x, 68, 1877: *Hyodon amphiodon* Raf. Ichth. Oh. 1820, 42.)

* Belly in front of ventrals not carinated; dorsal fin with 11 or 12 developed rays.

† Belly behind ventrals carinated.

433. H. tergisus Le Sueur.—*Moon Eye; Toothed Herring.*

Body oblong, moderately compressed. Eye large, 3 in head, the maxillary barely reaching its middle. Pectoral fins not reaching ventrals, the latter just short of vent. Belly behind ventrals somewhat carinate. Color silvery, olive-shaded above. Head $4\frac{1}{3}$; depth 3. D. 12; A. 28; scales 5–55–7. L. 12 inches. Great Lakes and Mississippi Valley; abundant in our larger streams. One of our handsomest fishes; not valued as food.

(Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 364, 1818: *Hiodon clodalus* Le Sueur, l. c. 367: *Cyprinus* (*Abramis?*) *smithi* Rich. Fauna Bor.-Amer. iii, 110; Günther, vii, 375; Jordan, Bull. U. S. Nat. Mus. x, 68, 1877.)

†† Belly nowhere carinated.

134. H. selenops Jordan & Bean.

Body more elongate, little compressed, not elevated. Belly nowhere carinate. Eye very large, $2\frac{1}{2}$ in head. Pectorals not reaching nearly to ventrals. Clear silvery. Head $4\frac{1}{8}$; depth 4. D. 12; A. 27; Lat. l. 50. Cumberland River and southward.

(Jordan & Bean, Bull. U. S. Nat. Mus. x, 68, 1877.)

FAMILY XXXVI.—ELOPIDÆ.

(*The Big-eyed Herrings.*)

Body elongate, not much compressed, covered with cycloid scales. Head naked. Mouth broad, terminal, the lower jaw prominent. Premaxillaries not protractile, short, the maxillaries forming the lateral margins of the upper jaw. Maxillary composed of about three pieces, extending backward beyond the eye. An elongate bony plate between the branches of the lower jaw (like the gular plate in *Amia*). Bands

of villiform teeth in both jaws and on vomer, palatines, pterygoids, tongue, and base of skull. No large teeth. Eye large, with an adipose eyelid. Gill-membranes entirely separate, free from the isthmus. Branchiostegals numerous (20–35). Gill-rakers long and slender. Pseudobranchiæ present or absent. Belly not keeled nor serrated, covered with ordinary scales. Lateral line present. Dorsal fin over or rather behind ventrals. Caudal fin forked. No adipose fin. Pyloric cœca numerous. Two genera, not much alike, with 4 or 5 species, widely distributed, sometimes entering fresh waters.

(*Clupeidæ* group *Elopina* Günther, vii, 469–472.)

* Body elongate, covered with small scales; anal fin smaller than dorsal. (*Elopinæ.*)
a. Pseudobranchiæ present ..... ELOPS, 118.
** Body oblong, covered with large scales; anal fin larger than dorsal. (*Megalopinæ.*)
b. Pseudobranchiæ obsolete ..... MEGALOPS, 119.

118.—ELOPS Linnæus.

Big-eyed Herrings.

(Linnæus, Syst. Nat: type *Elops saurus* L.)

Body elongate, covered with thin, small, silvery scales. Dorsal fin slightly behind ventrals, its last rays short, the fin depressible into a sheath of scales. Anal fin smaller, similarly depressible. Pectorals and ventrals moderate, each with a long accessory scale. Opercular bones thin, with expanded, membranaceous borders; a scaly occipital sheath or collar. Lateral line straight, its tubes simple. Pseudobranchiæ present, large. Species 2 or more, widely distributed, remarkable for the development of scaly sheaths. (ἔλοψ, name of some sea-fish—a sword-fish or sturgeon; from ἑλάω, to drive or move.)

435. E. saurus L.—*Big-eyed Herring.*

Uniform silvery, darker above. Gular plate 3–4 times as broad as long. Head $4\frac{1}{4}$; depth 5–6. Eye large, 4–5 in head. D. 20; A. 13; V. 15; B. 30; scales 12–120–13. L. 24 inches. Cape Cod to Cape of Good Hope and China. A handsome fish, not rare on our Atlantic coast.

(Linn. Syst. Nat.; Günther, vii, 470.)

119.—MEGALOPS Lacépède.

Tarpums.

(Commerson; Lacépède, Hist. Nat. des Poissons, v, 289, 1803: type *Megalops filamentosus* Lac. = *Clupea cyprinoides* Broussonet.)

Body oblong, compressed. Head large, compressed. Eye very large. Belly narrow, covered with ordinary scales. Mouth large, oblique.

Maxillary broad, extending beyond the eye. Villiform teeth on jaws, vomer, palatines, tongue, sphenoid, and pterygoid bones. Scales large, firm. Lateral line nearly straight, its tubes radiating widely in each of its scales. Dorsal fin short and high, over or behind ventrals; last ray of dorsal elongate, filamentous, as in *Dorosoma* and *Opisthonema*. Anal fin long, falcate, its last ray produced, its base much longer than that of the dorsal. Caudal fin widely forked. Pectorals and ventrals rather long. Gill-rakers long. Anal fin with a sheath of scales; dorsal fin naked; caudal fin largely scaly; nape with a collar of large scales. Pseudobranchiæ none. Species of very large size, largest of the Clupeoid fishes, found in all warm seas. (*μέγαλοψ*, large-eyed.)

* Origin of dorsal behind the ventrals.

436. M. thrissoides (Bloch & Schneider) Günther.—*Tarpum; Jew-fish.*

Uniform brilliant silvery, back darker. Body elongate, compressed, little elevated. Head 4 in length; depth $3\frac{4}{5}$. D. 12; A. 20; Lat. l. 42; B. 23. Dorsal filament longer than head. Atlantic Ocean, entering fresh water; common on our southern coasts, and noted for the great size of its scales, which are used in ornamental work.

(*Clupea thrissoides* Bloch & Schneider, 1801, 424; Günther, vii, 472.)

Family XXXVII.—CLUPEIDÆ.

(*The Herrings.*)

Body oblong or elongate, more or less compressed, covered with cycloid or pectinated scales. Head naked, usually compressed. Mouth rather large, terminal, the jaws about equal. Maxillaries forming the lateral margins of the upper jaw, each composed of about three pieces. Premaxillaries not protractile. Teeth mostly feeble or wanting, variously arranged. Gill-rakers long and slender. Gill-membranes not connected, free from the isthmus. No gular plate. Gills 4, a slit behind the fourth. Branchiostegals usually rather few (6–15). Posterior lower part of opercular region usually with an angular emargination, the tips of the larger branchiostegals being abruptly truncate. Pseudobranchiæ present. No lateral line (at least in our species). Dorsal fin median or somewhat posterior. No adipose fin. Ventrals moderate or small (wanting in *Pristigaster*). Anal usually rather long. Caudal fin forked. Belly sometimes rounded, sometimes compressed and armed with bony serratures. Genera 15; species 130; inhabiting all seas, and usually swimming in immense schools. Many species ascend fresh waters, and some

remain there permanently. The current genera are ill defined and apparently too numerous, and we have followed Dr. Günther in referring most of them to *Clupea*. The rudimentary teeth are extremely variable, even in the same species.

(*Clupeidæ* groups *Clupeina* and *Dussumieriina* Günther, vii, 412–467.)

* Belly rounded, covered with ordinary scales; supplemental bones of maxillary very narrow. (*Dussumieriinæ*.)
  a. Ventrals small, behind dorsal; teeth small, persistent on jaws, vomer, palatines, pterygoids, and tongue.....ETRUMEUS, 120.
  aa. Ventrals below dorsal; teeth wanting or deciduous.....SPRATELLOIDES, 121.
** Belly compressed, armed with bony serræ; supplemental bones of maxillary broad. (*Clupeinæ*.)
  b. Scales with their posterior margins entire and rounded.
    c. Last ray of dorsal not produced.
      d. Scales thin, deciduous.....CLUPEA, 122.
      dd. Scales firm, adherent, regularly arranged.....HARENGULA, 123.
    cc. Last ray of dorsal produced in a long filament.....OPISTHONEMA, 124.
  bb. Scales with their posterior margins vertical, and pectinate or fluted. BREVOORTIA, 125.

120.—ETRUMEUS Bleeker.

Round Herrings.

(Bleeker, Verh. Bat. Gen. xxv, Japan, 48: type *Clupea micropus* Schlegel, from Japan.)

Body elongate, fusiform, subcylindrical, snout pointed. Mouth terminal, rather wide, the maxillary extending to opposite the eye, its supplemental pieces slender; jaws and most of the bones of the mouth with small but permanent teeth. Scales cycloid, entire, very deciduous. Branchiostegals fine, about 15 in number. Pyloric cœca numerous. Belly rounded, covered with ordinary scales. Fins all small, the anal especially so. Ventrals behind dorsal. Two species known. (ἦτρον, abdomen; ὁμός, even?)

437. E. teres (DeKay) Günther.—*Round Herring.*

Olivaceous above, silvery on sides and below. Body terete and fusiform. Head slightly compressed forwards. Mouth small, maxillary reaching front of orbit. Eye large, equal to snout. Fins all very small. Vomerine teeth present. Head 4 in length; depth 6. D. 13; A. 10. Atlantic coast of the United States; not common.

(*Alosa teres* DeKay, New York Fauna, Fish. 1842, 262; Günther, vi, 467.)

121.—SPRATELLOIDES Bleeker.

(Bleeker, Verh. Bat. Gen. xxiv, Haring, 29: type *Clupea argyrotænia* Bleeker.)

Body elongate, subcylindrical or slightly compressed, covered with moderate-sized deciduous scales. Abdomen obtuse, without keel or

serrature. Mouth essentially as in *Clupea*. Teeth none, or minute and deciduous. Gill-membranes separate, with about 6 flat branchiostegals. Pseudobranchiæ well developed. Dorsal opposite ventrals; anal fin short. Stomach with long, blind sac; pyloric cœca in moderate number. Pacific and Indian Oceans. (*Spratellus*, sprat; εἶδος, resemblance.)

438. S. bryoporus Cope.

Form compressed, moderately elongate. Belly rounded, except between ventral fins and vent, where it is angular. Maxillary broad, flat, reaching to opposite middle of pupil. Ventrals a little in front of middle of dorsal. Lower fins short. Pectorals $2\frac{1}{2}$ in distance to ventrals. Golden; bluish above. Top of head with a bifurcate depression, filled with delicate, branching mucous tubules; opercular and postfrontal regions with similar tubes. Head 5; depth $4\frac{1}{2}$. D. 18; A. 18; scales 51–12. L. 14 inches. Coast of Alaska. (*Cope.*)

(Cope, Proc. Amer. Phil. Soc. Phila. 1873.)

122.—CLUPEA Linnæus.

Herrings.

(*Clupea, Alosa, Pomolobus, Meletta, Spratella*, etc., of authors.)

(Linnæus, Syst. Nat.: type *Clupea harengus* L.)

Body oblong, more or less compressed. Mouth moderate, terminal, the jaws about equal, or the lower projecting Teeth feeble, variously placed, rarely absent. Mandibles very deep at base, shutting within the maxillaries. Gill-rakers more or less long and slender, numerous. Scales thin, cycloid, deciduous, entire, rounded posteriorly. Dorsal fin rather short, nearly median, beginning in advance of ventrals, its posterior ray not prolonged in a filament. Ventrals present. Anal moderate. Belly compressed, more or less strongly serrated, at least behind ventrals. Species very numerous; found in all seas. (Latin *clupea*, a herring.)

Our species may be divided as follows:

* Vomer with an ovate patch of teeth; ventral serratures weak; herrings (CLUPEA). *harengus, mirabilis.*

** Vomerine teeth none.

† Cheeks longer than deep, the preopercle produced forward below. (POMOLOBUS Raf.)

a. Ventral serratures weak ..... *sagax.*

aa. Ventral serratures strong.

b. Jaws with persistent teeth ..... *chrysochloris.*

bb. Jaws without persistent teeth (MELETTA Val.). *mediocris, vernalis, æstivalis.*

†† Cheeks deeper than long; shad (ALOSA Cuvier) ..... *sapidissima.*

*Vomer with an ovate patch of teeth; ventral serratures weak; herrings. (*Clupea.*)

439. C. harengus L.—*Common Herring; "Whitebait" (young).*

Bluish; silvery below, with bright reflections. Body elongate, compressed. Scales loose. Cheeks longer than high, the junction of the mandible and preopercle under middle of eye. Maxillary extending to middle of eye. Upper jaw not emarginate. Lower jaw much projecting. Gill-rakers very long, fine and slender, about 40 on the lower part of the arch. Eye longer than snout, 4 in head. Dorsal inserted rather behind middle of body, in front of ventrals. Pectorals and ventrals short; anal low. Abdomen serrated in front of ventrals as well as behind. Peritoneum dusky. Head $4\frac{1}{2}$; depth $4\frac{1}{2}$. D. 18; A. 17; Lat. l. 57; ventral scutes 28 + 13; vertebræ 56. Atlantic Ocean; abundant on the coasts both of Europe and America. Spawns in the sea.

(Linn. Syst. Nat.; Günther, vii, 415: *Clupea elongata* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 234.)

440. C. mirabilis Girard.—*California Herring.*

Bluish above; sides and below silvery; peritoneum dusky. Lower jaw strongly projecting; upper jaw not emarginate. Belly scarcely compressed in front of ventrals, serrate only between ventrals and anal. Gill-rakers very long and slender. Vomerine teeth weaker than in *C. harengus;* usually a few teeth on tongue and premaxillary. Vertebræ also fewer, 30 + 20 = 50. Insertion of dorsal slightly nearer front of eye than base of caudal. Head $4\frac{1}{3}$; depth 4. D. 16; A. 14; Lat. l. 52. Pacific coast of North America. Very similar to *C. harengus*, and equally abundant.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 138; Günther, vii, 418.)

** Vomerine teeth none.

† Cheeks longer than deep, the preopercle produced forward below. (*Pomolobus* Rafinesque.*)

a. Ventral serratures weak; mouth entirely toothless.

441. C. sagax Jenyns.—*California Sardine; Sadina.*

Dark bluish above; silvery below; a series of round black spots on the level of the eye, running backward, bounding the dark color of the back; similar smaller spots above, forming lines along the rows of scales; these spots rarely obscure or wanting, especially in old examples; tip of lower jaw yellow; lower part of dorsal yellow; peritoneum black. Body very slender, subsiform, slenderer and less compressed than a herring, the back rather broad. Ventral serratures very weak. Maxillary reach-

* Rafinesque, Ichth. Oh. 1820, 38: type *Pomolobus chrysochloris* Rafinesque. (πῶμα, operculum; λοβός, lobe.)

ing nearly to middle of eye. Mandible little projecting, the tip included. Gill-rakers longer than eye, very slender and numerous, close-set. Opercles, top of head, and scapular region with conspicuous branching tubes and striæ. Insertion of dorsal considerably nearer snout than base of caudal. Pectorals and ventrals with sheathing scales. Head 4; depth 5. D. 15; A. 17; Lat. l. 53; scutes 18+14. L. 12 inches. Pacific coast of North and South America; very abundant, spawning in the sea. Resembles the European Sardine (*C. pilchardus*), but has no teeth, and the belly less strongly serrate.

(Jenyns, Zoöl. Beagle, Fish. 134: *Meletta cærulea* Girard, U. S. Pac. R. R. Surv. x, 330: *Alosa musica* Grd. U. S. Nav. Astron. Exped. Zoöl. 246: *Alausa californica* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 281; Günther, vii, 443.)

aa. Ventral serratures strong.

b. Jaws with persistent teeth, at least on premaxillaries, and sometimes on symphysis of lower jaw.

442. C. chrysochloris (Raf.) Jor. & Gilb.—*Ohio Shad; Skipjack.*

Brilliant blue above; sides silvery, with golden reflections; no dark spot behind opercle. Body elliptical, highest near the middle, much compressed. Head rather slender and pointed, its upper profile straight. Lower jaw strongly projecting, its tip entering the profile; upper jaw emarginate. Premaxillary, and often tip of lower jaw, with moderate-sized teeth. Maxillary large, reaching to opposite posterior part of eye. Eye large, well covered by adipose eyelid. Fins moderate. Caudal peduncle slender, the caudal widely forked. Gill-rakers comparatively few, short, stout, and coarse, about 23 below the angle of the arch. Opercles with radiating and branching striæ. Peritoneum pale. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. Eye shorter than snout, $4\frac{1}{3}$ in head. D. 16; A. 18; Lat. l. 52; ventral scutes 20+13. L. 15 inches. Gulf of Mexico and Mississippi Valley; abundant, and resident in all the larger streams, and introduced through the canals into Lake Erie and Lake Michigan. A handsome fish, not valued for food.

(*Pomolobus chrysochloris* Raf. Ichth. Oh. 1820, 38.)

b. Jaws without persistent teeth; a few teeth usually present on the tongue. (*Meletta* Val.)

443. C. mediocris Mitchill.—*Hickory Shad; Tailor Herring; Fall Herring.*

Bluish silvery; sides with rather faint longitudinal stripes. Head comparatively long, the profile straight and not very steep, form more elliptical than in the others and less heavy forwards. Lower jaw considerably projecting; upper jaw emarginate. Opercles rather less emarginate below and behind than in *C. vernalis*. Fins low; dorsal

fin inserted nearer snout than base of caudal. Peritoneum pale. Head 4; depth $3\frac{3}{8}$. D. 15; A. 21; Lat. l. 50; ventral scutes 20 + 16. Newfoundland to Florida; rather common. Little valued as a food-fish.

(Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 451: *Clupea mattowacca* Günther, vii, 438: *Alosa lineata* Storer, Proc. Bost. Soc. Nat. Hist. ii, 242, and Hist. Fish. Mass. 162.)

444. C. vernalis Mitch.—*Alewife; Branch Herring; Gaspereau.*

Blue above; sides silvery; indistinct dark stripes along the rows of scales; a blackish spot behind opercle. Body rather deep and compressed, heavy forward. Head short, nearly as deep as long, the profile somewhat steep and slightly depressed above the nostrils. Maxillary extending to posterior margin of pupil. Lower jaw somewhat projecting; upper jaw emarginate. Eye large, slightly longer than snout, $3\frac{1}{2}$ in head. Gill-rakers long, 30–40 below the angle of the arch, shorter and stouter than in *C. sapidissima*. Lower lobe of caudal the longer. Dorsal fin high, a little higher than long, its height $6\frac{1}{2}$ in length of body. Head $4\frac{2}{3}$; depth $3\frac{1}{3}$. D. 16; A. 19; Lat. l. 50; scutes 21 + 14. Peritoneum pale. Atlantic coast of the United States; abundant; entering streams to spawn; land-locked in the lakes of Western New York.

(Mitchill, Rept. Fish. N. Y. 22, and Trans. Lit. & Phil. Soc. N. Y. i, 454: *Clupea pseudoharengus* Wilson, Rees's Encycl.: *Alosa tyrannus* Storer, Hist. Fish. Mass. 156: *Pomolobus pseudoharengus* Gill, Rept. U. S. Fish Com. 1871–'72, 811: *Pomolobus vernalis* Goode & Bean, Bull. Essex Inst. 1879, 24.)

445. C. æstivalis Mitchill.—*Glut Herring; Blue-back.*

Very similar to the preceding, from which it is best distinguished by the black peritoneum. The fins are lower and the eyes smaller. Atlantic coast, appearing later than the preceding; less abundant and less valuable as a food-fish.

(*Clupea æstivalis* Mitch. Trans. Lit. & Phil. Soc. N. Y. i1, 1814, 456: *Alosa cyanonoton* Storer, Hist. Fish. Mass. 161: *Pomolobus æstivalis* Goode & Bean, Bull. Essex Inst. 1879, 24.)

†† Cheeks deeper than long, the preopercle scarcely prolonged anteriorly below; no teeth, or a few, caducous, on the jaws; shad. (*Alosa* Cuvier.*)

446. C. sapidissima Wilson.—*Common Shad.*

Bluish above; sides white or silvery; a dark spot behind opercle, and sometimes several along the line dividing the color of the back from that of the sides; axil dusky; peritoneum white. Body comparatively deep. Mouth rather large, the jaws about equal, the lower fitting into a notch in the tip of the upper. Preorbital moderate. Cheeks much

* Cuvier, Règne Anim. ed. 2, 1829: type *Clupea alosa* L. (Latin *alausa* or *alosa*, an early name of the shad; English *allis*, German *alse*, Latin *halec*.)

deeper than long, the preopercle extending little forward, joining the mandible at a point rather behind the eye. Gill-rakers extremely long and slender, much longer than eye, about 60 below the angle of the arch. Fins small. Dorsal much nearer snout than base of caudal. Head $4\frac{1}{4}$; depth 3. D. 15; A. 21; Lat. l. 60; ventral scutes 21 + 16. Atlantic coast of the United States; ascending rivers to spawn. One of the most important of our food-fish. Also introduced on the Pacific coast.

(Wilson, Rees's Encyclopedia: *Alosa præstabilis* DeKay, New York Fauna, Fish. 255: *Alosa sapidissima* of most late American writers.)

123.—HARENGULA Valenciennes.

(Valenciennes, Hist. Nat. Poiss. xx, 277, 1847: type *Harengula latulus* Val.)

Characters essentially those of the genus *Clupea*, except that the scales are firm, adherent, and regularly arranged. (Latin diminutive of *harengus*, herring.)

447. H. pensacolæ Goode & Bean.

Body deep, with projecting belly, formed much as in the shad. Head very short. Scales of the back in front of dorsal with radiating striæ and sharply serrated edges; other scales smooth, with irregular but unarmed free margins; scales all marked with wavy lines, sometimes forming reticulations. Lower jaw rather long, maxillary extending beyond front of orbit. Teeth very small, inconspicuous in the jaws. A large patch of asperities on the tongue. Gill-rakers fine, close set, shorter than the eye, about 56 below the angle. Eye large, longer than snout, 3 in head. Head 4; depth 3. D. 16; A. 17; Lat. l. 40; scutes 12 behind ventrals. Pensacola, Fla. (*Goode & Bean.*)

(*Harengula pensacolæ* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 152.)

124.—OPISTHONEMA Gill.

Thread Herring.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 37: type *Clupea thrissa* Osbeck.)

Characters essentially those of *Harengula*, except that the last ray of the dorsal is produced in a long filament as in *Dorosoma*. (ὄπισθε, behind; νῆμα, a thread.)

448. O. thrissa (Osbeck) Gill.

Bluish above; silvery below; an indistinct bluish shoulder-spot; each scale on the back with a dark spot, these forming longitudinal streaks. Body oblong, compressed. Belly strongly serrate. Tongue with minute teeth. Jaws toothless; lower jaw slightly projecting; maxillary reach-

ing nearly to middle of orbit. Gill-rakers very long and slender. Dorsal fin inserted in front of ventrals, much nearer snout than base of caudal. Dorsal filament about as long as head. Anal very low. Paired fins small. Scales rather firm, smooth. Head 4; depth 3½ in length. D. 19; A. 24; Lat. l. 50; scutes 17 + 14. Atlantic coasts of America, chiefly southward, the flesh said to be sometimes poisonous.

(*Clupea thrissa* Osbeck, Reise, 336: *Clupea thrissa* Günther, vii, 432: *Clupea libertatis* Günther, vii, 433, Pacific coast of Central and South America, is at least very similar.)

125.—BREVOORTIA Gill.

Menhadens.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 37: type *Clupea menhaden* Mitch. = *Clupe tyrannus* Latrobe.)

Body elliptical, compressed, deepest anteriorly, tapering behind. Head very large. Cheeks deeper than long. Mouth large, the lower jaw included. No teeth. Gill-rakers very long and slender, densely set. Gill-arches angularly bent. Scales deeper than long, closely imbricated, their exposed edges vertical, and fluted or pectinated. Dorsal fin low, rather posterior. Anal fin small. Intestinal canal elongate. Peritoneum dusky. Species few, inhabiting the Atlantic. (Dedicated to J. Carson Brevoort.)

* Scales with their edges entire, fluted.

449. B. patronus Goode.

Head larger than in *B. tyrannus*. Fins long, the height of the dorsal greater than the length of the maxillary; that of the anal more than half the height of the maxillary. Pectorals reaching beyond front of ventrals; insertion of dorsal in front of ventrals, just behind the middle point between the snout and the base of the caudal. Scales moderate, with their margins entire, fluted. Axillary appendages large. Large scales at base of pectoral. Operculum delicately striated. Greenish gray above; sides silvery, with brassy lustre; scapular blotch inconspicuous. Head 3 in length; depth 2⅔. D. 19; A. 22; Lat. l. 50–65. Gulf of Mexico. (*Goode.*)

(Goode, Proc. U. S Nat. Mus. i, 39, 1878.)

** Scales everywhere with their edges strongly serrated.

450. B. tyrannus* (Latrobe) Goode.—*Menhaden; Mossbunker; Bony-fish; White-fish; Bug-fish; Fat-back; Yellow-tail.*

Head and jaws shorter than in *B. patronus*. Fins comparatively short,

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*A parasitic Crustacean (*Oniscus prægustator* Latrobe) is found in the mouths of a very large proportion of the individuals of this species. The specific names both of the fish and the Crustacean refer to this peculiarity, the ancient Roman rulers (*tyranni*) having had their tasters (*prægustatores*) to taste their food before them, to prevent poisoning.

the height of the dorsal less than the length of the maxillary; height of anal less than half the length of the maxillary. Pectorals not reaching to ventrals. Dorsal inserted slightly behind ventrals, about midway between snout and base of caudal. Scales moderate, strongly serrated, arranged very irregularly. Operculum strongly striated or almost smooth (var. *aurea*). Gill-rakers much longer than eye. Bluish above; sides silvery, with a strong brassy lustre; fins usually yellowish; a conspicuous dark scapular blotch, behind which are often smaller spots. Head $3\frac{1}{5}$; depth 3. D. 19; A. 20; Lat. l. 60–80; ventral plates 20 + 12. L. 12–18 inches. New England to Brazil; very abundant southward, spawning in the sea. Held in no esteem as a food-fish, but very valuable for oil and manure; the young canned as sardines.

(*Clupea tyrannus* Latrobe, Trans. Amer. Phil. Soc. Phila. v, 77, 1802: *Clupea menhaden* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 453, 1814: *Clupea menhaden* Günther, vii, 436: *Clupanodon aureus* Agassiz, Spix. Pisc. Bras. 52 (Brazilian var. *aurea* Goode): *Clupea aurea* Günther, vii, 437: *Alosa menhaden* Storer, Hist. Fish. Mass. 337; Goode, Proc. U. S. Nat. Mus. i, 5, 31, 1878; Goode, Rept. U. S. Fish Comm. for 1877, complete biography.)

Family XXXVIII.—DOROSOMATIDÆ.

(*The Gizzard Shads.*)

Body short and deep, strongly compressed, covered with thin, deciduous, cycloid scales. Belly compressed to an edge, which is armed with bony serratures. Head naked, short, rather small. Mouth small, inferior, oblique, overlapped by the blunt snout; no teeth. Maxillary narrow and short, with a single supplem ntal bone, not extending to opposite the middle of the eye, and forming but a small portion of the lateral margin of the upper jaw. Mandible short and deep, its rami enlarged at base. Premaxillary not protractile. Gill-rakers slender, exceedingly numerous, not very long, similar on all the arches. Gill-membranes not united, free from the isthmus. Pseudobranchiæ large. An adipose eyelid. No lateral line. Dorsal fin about midway of the body, usually behind ventrals. Pectorals and ventrals moderate, each with an accessory scale. Anal very long and low. Caudal forked. No adipose fin. Stomach short, muscular, like the gizzard of a fowl. Genera 2, species about 12. Mud-eating fishes of the coasts and rivers of warm regions, of little value as food.

(*Clupeidæ* group *Chatoëssina* Günther, vii, 406–411.)

* Last ray of dorsal produced in a long filament. . . . . Dorosoma, 126.

126.—DOROSOMA Rafinesque.

Gizzard Shad.

(*Chatoëssus* Cuvier, 1829.)

(Rafinesque, Ichth. Oh. 1820, 39: type *Dorosoma notata* Raf. = *Clupea heterura* Raf.)

Characters of the family, with the addition that the last ray of the dorsal is prolonged and filiform as in *Opisthonema* and *Megalops*. (δόρυ, a lance; σῶμα, body; in allusion to the form of the body in the young.)

451. D. cepedianum (Le S.) Gill.—*Gizzard Shad; Hickory Shad.*

Silvery; bluish above; young with a round dark spot at the shoulder; tips of ventrals and edge of anal often dusky. Body deep, compressed, the back elevated in the adults. Dorsal about median, its filamentous ray about as long as head, sometimes longer, sometimes shorter. Caudal widely forked, the lower lobe the longer. Head $4\frac{1}{3}$; depth $2\frac{2}{3}$. Eye $4\frac{1}{2}$ in head. D. 12; A. 31; Lat. l. 56; L. transv. 23; scutes 17 + 12. L. 15 inches. Cape Cod to Mexico; abundant southward, entering all rivers, and permanently resident ("var. *heterurum*") everywhere in the Mississippi Valley in the larger streams; also introduced into Lake Michigan and Lake Erie, and land-locked in ponds from New Jersey to Nebraska and Texas. A handsome fish, of no value as food.

(*Megalops cepediana* Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, 361: *Chatoëssus cepedianus* Günther, vii, 409: *Clupea heterura* Raf. Amer. Month. Mag. 1818, 354: *Chatoëssus ellipticus* Kirtland, Bost. Journ. Nat. Hist. iv, 235.)

Family XXXIX—ENGRAULIDIDÆ.

(*The Anchovies.*)

Body elongate, more or less compressed, covered with thin, cycloid scales. Head compressed. Mouth extremely large, nearly horizontal, usually overlapped by a pointed, compressed, pig-like snout. Gape very wide, the maxillary very long and slender, formed of about three pieces, extending backward far behind the eye; in some genera, much beyond the head. Premaxillaries not protractile, very small, firmly joined to the maxillaries. Teeth small, variously arranged, usually fine and even, in a single row in each jaw. Eye large, well forward, so that the snout is very short. Preorbital narrow. Opercles little developed, membranaceous. Gill-rakers long and slender. Branchiostegals slender, 7–14 in number. Gill-membranes separate or joined, free from the isthmus. Pseudobranchiæ present. No lateral line. Belly rounded or weakly

serrate. Fins various. No adipose fin. Caudal forked. Small fishes; usually swimming in large schools. Abundant in all warm seas, occasionally entering rivers. Genera 9, species about 60.

(*Clupeidæ* group *Engraulidina* Günther, vii, 383–406.)

* Gill-membranes scarcely connected, the gill-openings being extremely wide; no pectoral filaments; anal fin moderate, its origin behind that of the dorsal; upper jaw projecting beyond lower; maxillaries not extending beyond gill-openings; teeth small, or wanting, in one or both jaws...STOLEPHORUS, 127.

127.—STOLEPHORUS Lacépède.

Anchovies.

(*Engraulis* Cuvier, 1817.)

(Lacépède, Hist. Nat. Poiss. v, 381, 1803: type *Atherina japonica* Gmelin.)

Body oblong, compressed, covered with rather large, thin, deciduous scales. Snout conical, compressed, projecting. Maxillary extending backward far behind eye, about to the base of the mandible. Operculum narrow, membranaceous. Teeth small, usually on the jaws, vomer, palatines, and pterygoids, those of one or both jaws sometimes obsolete. Anal fin moderate, free from caudal (its rays 15–40). No pectoral filaments. Dorsal about midway of body, posterior to ventrals. Pectorals and ventrals each with an accessory scale. Adipose eyelid obsolete. Branchiostegals 9–14. Gill-membranes not united, leaving the narrow isthmus uncovered. Species about 25, in all warm regions. (στολή, a stole, a white band worn by priests; φορὸς, bearing; in allusion to the silvery lateral band.)

* Teeth fine, even, numerous, persistent in both jaws.
† Sides without distinct silvery band.

452. S. ringens (Jenyns) Jor. & Gilb.—*Anchovy.*

Bluish above; sides and below silvery, not translucent. No silvery lateral band. Body little compressed, rounded above, slightly carinated below, not serrated. Head long, anteriorly compressed, the snout pointed and protruding. Head nearly twice as long as deep. Eye large, very near the tip of the snout. Maxillary extending beyond root of mandible. Opercle deeper than long, placed very obliquely. Gill-rakers very long, much longer than the eye. Head $3\frac{1}{2}$; depth $5\frac{1}{2}$. D. 14; A. 22; Lat. l. 40; B. 14. L. 7 inches. Pacific coast, from Vancouver's Island to Peru; extremely abundant. The largest of our anchovies.

(*Engraulis ringens* Jenyns, Voyage Beagle, 136: *Engraulis ringens* Günther, vii, 386: *Engraulis mordax* Girard, U. S. Pac. R. R. Surv. x, 334: *Engraulis nanus* Girard, l. c.

335 (much smaller and more compressed, probably the young of *S. ringens*, but occurring in large schools): *Engraulis pulchellus* Girard, U. S. Nav. Astron. Exped. Zoöl. Fish. 247.)

†† Sides with a distinct silvery lateral band.

‡ Belly compressed to an edge and faintly serrated.

453. S. browni (Gmel.) J. & G.—*Anchovy.*

Olivaceous; sides silvery; the silvery lateral band about as wide as the eye, very distinct, more so than in our other species. Body rather elongate, compressed, not elevated. Head rather short, the snout projecting much beyond the tip of the lower jaw. Teeth pretty strong, maxillary extending beyond base of mandible, but not quite reaching to the edge of the gill-opening. Eye large, $3\frac{1}{4}$ in head. Gill-rakers long, but shorter than in *S. compressus*. Anal with a sheath of scales; dorsal inserted nearer caudal than snout. Head $3\frac{3}{4}$; depth $4\frac{3}{4}$. D. 12; A. 20; Lat. l. 40. L. 4–6 inches. Cape Cod to Brazil; very abundant southward.

(*Atherina browni* Gmel. Syst. Nat. 1397; Günther, vii, 389: *Clupea vittata* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 456: *Engraulis mitchilli* Günther, vii, 391: *Engraulis vittatus* of most recent writers.)

454. S. hiulcus (Goode & Bean) Jor. & Gilb.

Snout somewhat compressed. Maxillary slightly dilated, ending in an acute point, which extends backward to the gill-openings, toothed along its entire lower edge; minute teeth in both jaws. Gill-rakers not very numerous, the longest as long as the eye. Origin of dorsal midway between posterior margin of orbit and the root of the caudal. Lateral stripe one-third the height of the body. Head $3\frac{2}{5}$ in length; depth $5\frac{1}{2}$. Eye greater than snout. D. 15; A. 22. (*Goode & Bean.*) Clear Water Harbor, Florida. Evidently closely related to *S. browni*.

(*Engraulis hiulcus* Goode & Bean, Proc. U. S. Nat. Mus. ii, 343, 1879.)

‡‡ Belly not carinated or serrated.

a. Body not strongly compressed, very slender.

455. S. perfasciatus (Poey) Jor. & Gilb.

Body elongate, much slenderer than in *S. browni*, and not so much compressed. Head not so deep as in *S. browni*, more pointed, the snout rather sharp. Eye rather small, $4\frac{1}{2}$ in head, not longer than snout. Maxillary teeth well developed; mandibulary teeth very slender. Gill-rakers very long, as long as eye. Maxillary shorter than in *S. browni*, not reaching quite to the base of the mandible. Belly slightly compressed, not serrated. Scales very deciduous. Ventrals short, very

slightly in front of dorsal. Caudal peduncle long and slender. Dorsal inserted scarcely nearer caudal than snout. Silvery stripe broad, half wider than the eye, bordered above by a dusky streak. Head $3\frac{4}{5}$; depth 6. D. 12; A. 20. L. 4 inches. West Indies; occasional northward. A specimen in our collection from Wood's Holl, Mass.

(*Engraulis perfasciatus* Poey, Mem. Cuba, ii, 312: *Engraulis perfasciatus* Günther, vii, 391.)

aa. Body strongly compressed, translucent in life.

456. S. delicatissimus (Girard) Jor. & Gilb.

Very pale, olivaceous, translucent, with some dark points, and a silvery lateral band not as wide as the eye. Head short, nearly as deep as long. Eye large, much longer than the blunt snout, which projects considerably beyond the lower jaw. Gill-rakers numerous, slender, nearly as long as the eye. Maxillary reaching past the root of the mandible. Lower lobe of caudal the longer. Anal rather long. Dorsal inserted midway between caudal and front of eye. Head $4\frac{1}{4}$; depth $4\frac{3}{4}$. D. 13; A. 23. Lat. l. 40. L. 3 inches. San Diego Bay and southward; locally abundant.

(*Engraulis delicatissimus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 154, and U. S. Pac. R. R. Surv. x, 333: *Engraulis delicatissimus* Günther, vii, 391.)

457. S. compressus (Girard) Jor. & Gilb.—"*Sprat.*"

Very pale, olivaceous, translucent; a silvery lateral band as broad as the eye. Body strongly compressed, deeper than in other species. Head short, nearly as deep as long. Eye large, anterior, much longer than the blunt snout, which does not project much beyond the lower jaw. Gill-rakers numerous, slender, nearly as long as the eye. Maxillary reaching beyond the root of the mandible. Lower lobe of caudal the longer. Anal fin very long. Dorsal inserted midway between caudal and front of eye. Pectoral with a basal sheath. Head $4\frac{1}{2}$; depth $3\frac{3}{4}$. D. 12; A. 31. Lat. l. 40. L. 6 inches. Very similar to *S. delicatissimus*, but larger, with a longer anal fin. Point Concepcion to Mexico; abundant southward.

(*Engraulis compressus* Girard, U. S. Pac. R. R. Surv. Fish. 336: *Engraulis compressus* Günther, vii, 395.)

Family XL.—ALEPIDOSAURIDÆ.

(*The Lancet-fishes.*)

Body elongate, rather compressed, scaleless. Head compressed, with the snout much produced, and with the cleft of the mouth very wide. Premaxillary very long and very slender, forming the entire margin of the upper jaw, not protractile. Maxillary thin, needle-like, as long as

the premaxillary, immovable. Teeth very unequal, immovable, and subject to many variations in the same species; a series of small teeth the entire length of the premaxillary; those in front sometimes larger and curved. Palatine teeth compressed, triangular, pointed; two or three of the anterior ones exceedingly long and strong, fang-like; the posterior ones moderate. Teeth of the lower jaw similar to those on the palatines, one pair in front and two or three pairs in the middle being much enlarged. No teeth on the tongue. Eye large. Gill-openings very wide; the gill-membranes not united, free from the isthmus. Gill-rakers stiff, shortish, spine-like. Branchiostegals 5–7. Pseudobranchiæ large. Opercular bones thin, membranaceous. Dorsal fin very long, occupying nearly the whole of the back, of more than 40 rays; adipose fin present, moderate; anal fin moderate; caudal fin forked. Air-bladder none. Large fishes of the deep seas, found in the Atlantic and Pacific. One genus and 6 or 8 species. Every part of the *Alepidosaurus* is so fragile that it is extremely difficult to procure specimens. The structure of the dorsal fin is so delicate that it must be liable to injury even in the water; the bones are very feebly ossified, and the fibrous ligaments connecting the vertebræ are very loose and extensible, so that the body may be considerably stretched. "This loose connection of the single parts of the body is found in numerous deep-sea fishes, and is merely the consequence of their withdrawal from the pressure of the water to which they are exposed in the depths inhabited by them. When within the limits of their natural haunts the osseous, muscular, and fibrous parts of the body will have that solidity which is required for the rapid and powerful movements of a predatory fish. That fishes of this genus (*Alepidosaurus*) belong to the most ferocious of the class is proved by their dentition and the contents of their stomach, but it is worthy of notice that although the mouth is so deeply cleft, the lower jaw cannot be moved from the upper at a greater angle than about 40°." (*Günther.*)

(*Scopelidæ*, group *Alepidosaurina* Günther, v, 420–423.)

128.—ALEPIDOSAURUS Lowe.

Lancet-fishes.

(*Alepisaurus* Lowe, Proc. Zoöl. Soc. Lond. 1833, 104: type *Alepisaurus ferox* Lowe.)

Characters of the genus included above. The name *Plagyodus* Steller (Pallas, Zoogr. Ross. Asiat. iii, 383) has been lately accepted by Dr. Günther for this genus. A specimen of one of the Pacific species was obtained by Steller from the Kurile Islands, and a brief description of

it, under the name of *Plagyodus*, left by him in manuscript, was afterwards quoted by Pallas, without indorsement. Steller wrote before Linnæus, and apparently used the name *Plagyodus* as a mononomial designation for his particular specimen or species, and not in the sense of a Linnæan genus. It seems to us, at present, best to retain the name *Alepidosaurus*. (*a*, privative; λεπὶς, scale; σαῦρος, Saurus = Synodus.)

* Ventral rays 9 or 10. (*Alepidosaurus.*)

458. A. ferox Lowe.—*Lancet-fish.*

The length of the head is twice the height of the body, and rather less than one-sixth of the total. Eye median, 6 in head, as wide as the interorbital space. Dorsal fin much elevated; pectorals elongated, but not reaching nearly to ventrals; first ray of dorsal, pectoral, and ventral serrated. Upper caudal lobe produced into a long filament. D. 41–44; A. 14–17; P. 14–15; V. 9–10. (*Günther.*) Deep waters of the Atlantic; lately obtained off the coast of Massachusetts by the United States Fish Commission. A specimen of this or some closely-related species has been procured by Dr. Bean in Alaska.

(*Alepisaurus ferox* Lowe, Trans. Zoöl. Soc. Lond. i, 395; Günther, v, 421.)

**Ventral rays 13. (*Caulopus* Gill.*)

459. A. borealis Gill.—*Handsaw-fish.*

Dorsal fin with about 34 rays, the first of which is rather stout, and anteriorly has a prominent compressed ridge, which is crenulated in front. Ventral fins at least as long as the head. V. 13; B. 5. Monterey to Alaska; occasionally cast on shore.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 128: *Alepidosaurus borealis* Günther, v, 423: *Caulopus serra* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 131, from Monterey; known by a mutilated specimen only, which "differs from *C. borealis* by the oblong operculum, the nearly equal triangular shape of the coalescent infraopercular bone above the dividing ridge, but with an oblique excavation at its base, which describes nearly the third of a circle, as well as the sculpture of the portion below the dividing ridge".)

Family XLI.—PARALEPIDIDÆ.

(*The Paralepids.*)

Body elongate, somewhat compressed, formed much as in a Barracuda, covered with cycloid scales of moderate or rather large size. Head long, usually scaly on the sides. Mouth very large, lower jaw projecting. Premaxillary not projectile, very long and slender, forming the entire margin of the upper jaw. Maxillary long and slender, closely adherent

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* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 128: type *Alepisaurus altivelis* Poey, from Cuba. (καυλὸς, stem; πούς, foot; *i. e.*, ventral fins of many stems or rays.)

to the premaxillary. Teeth rather strong, pointed, in single series on the jaws and palatines; some of them on lower jaw and palatines sometimes very long and fang-like, and most of them freely depressible. Opercular bones thin. Pseudobranchiæ present. Gill-membranes separate, free from the isthmus. Branchiostegals about 7. Gill-rakers short, sharp, spine-like. Eye large. Lateral line present, its scales usually enlarged. Dorsal fin short and small, behind the middle of the body, nearly or quite over the ventrals. Adipose fin present; anal fin low, rather long; caudal fin short, narrow, forked; pectorals rather small, placed low. Pyloric cœca none. No air-bladder. Phosphorescent spots few or none. Fishes of the deep waters of the Atlantic and Pacific, resembling *Sphyræna* in form and dentition. A single genus and about 5 species are now known.

(*Scopelidæ*, g oup *Paralepidina* Günther, v, 418, 420.)

129.—SUDIS Rafinesque.

(*Paralepis* Risso.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi, etc. 1810, 60: type *Sudis hyalina* Raf. of the Mediterranean.)

Characters of the genus included above. Two genera are usually recognized, differing in the development of the canines of the lower jaw, a character which appears to be of minor importance. (Latin *sudis*, a stake, an ancient name of *Sphyræna*.)

*Lower jaw with 3–5 very long fang-like teeth on each side. (*Sudis*.)

460. S. ringens Jordan & Gilbert.

Body very slender and elongate, compressed, the depth forming about one-sixteenth of the length. Head rather slender, anteriorly pointed and moderately depressed. Mouth large, horizontal, the gape extending more than half the length of the head. Margin of the upper jaw formed entirely by the very slender, nearly straight premaxillaries, which are closely appressed to the long and slender maxillaries. Maxillaries extending to below the eye, nearly as far as the mandibular joint. Tip of upper jaw emarginate; tip of lower jaw rather broad, turned up, and fitting in the notch of the upper jaw. Premaxillaries armed with a series of small, sharp, subequal, close-set teeth, which are hooked backward; a long, slender canine in front on each side. Lower jaw with about 10 sharp, slender teeth on each side, these teeth very unequal, some of them short, three or four very long and canine-like. Near the front is one fang-like tooth on each side, then a considerable interspace,

behind which the others are arranged partly in two rows. Most of these teeth, especially the inner and larger ones and the anterior canines, are freely depressible. A long series of teeth on the palatines, one or two of the anterior teeth on each side and one or two others long, slender, and fang-like. Tongue free anteriorly, roughish, but apparently without teeth. Scales very large, cycloid. Dorsal fin inserted somewhat behind the middle of the body, at a distance of nearly 4 times its base in front of the anal, its height a little greater than the length of its base. D. 11; A. 25. Anal fin anteriorly nearly as high as the dorsal, its posterior rays low. Pectoral fins placed low, rather short, about as long as the maxillary. Caudal fin short, narrow, apparently forked. Ventrals (lost in the type) probably in front of the dorsal. Coloration light olive, the sides silvery, with dark punctulations. Peritoneum silvery, underlaid by black pigment. Santa Barbara Channel, California.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 273.)

**Lower jaw without fang-like teeth. (*Paralepis* Risso.*)

a. Ventral fins inserted behind the dorsal. (*Arctozenus* Gill.)

461. S. borealis (Reinhardt) Jordan & Gilbert.

Olivaceous. Snout as long as rest of head; mandible included, its upturned tip fitting into an emargination of upper jaw. Teeth as in *S. coruscans*, but considerably stronger. Pectoral and ventral fins small, the latter inserted behind the dorsal. Head $4\frac{1}{3}$; depth 12. B. 7; D. 8; A. 32; P. 11; V. 9. Greenland to Gulf of Saint Lawrence.

(*Paralepis borcalis* Reinhardt, Naturv. Mathem. Afhandl. vii, 115: *Paralepis borealis* Günther, v, 418: *Arctozenus borealis* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 188.)

462. S. coruscans Jor. & Gilb.

Dusky olivaceous; sides of head silvery; bases of fins generally black; rami of mandible each with a double series of minute phosphorescent spots. Body very elongate, of nearly uniform depth, the caudal peduncle very slender; abdomen compressed. Head long; snout sharp, half length of head. Eye large, high. Jaws equal; maxillary reaching vertical from nostril; tip of lower jaw fitting into an emargination of premaxillaries. None of the teeth fang-like; premaxillaries laterally with minute teeth; 4 or 5 longer teeth in front; vomer with minute teeth; anterior palatine teeth long, the posterior short; teeth of lower jaw slender, distant, unequal. Scales deciduous, those of lateral line enlarged. Fins all very small; ventrals entirely behind

*Risso, Eur. Mérid. iii, 472, 1826: type *Coregonus paralepis* Risso. (παρά, near; λεπίς, scales.)

dorsal, their distance from front of orbit twice that from base of caudal; distance of front of dorsal to base of caudal half its distance from tip of snout; caudal widely forked. Head 4; depth 13. D. 8; A. 31; P. 11; V. 9. Lat. l. 60. Puget Sound, scarcely differing from the preceding, the teeth a little weaker.

(*Paralepis coruscans* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 411.)

Family XLII.—SCOPELIDÆ.

(*The Scopelids.*)

Body oblong or elongate, compressed or not, naked or covered with scales, which are usually cycloid. Mouth very wide, the entire margin of the upper jaw formed by the long and slender premaxillaries, closely adherent to which are the slender maxillaries, the latter sometimes rudimental or obsolete. Teeth various, mostly cardiform on both jaws, tongue, and palatines; canines often present; large teeth usually depressible. No barbels. Opercular bones usually thin, often incomplete. Gill-membranes separate, free from the isthmus. Branchiostegals usually numerous. Pseudobranchiæ present. Gill-rakers various. Lateral line usually present. Cheeks and opercles commonly scaly. Adipose fin present in most of the genera. Dorsal fin short, median or rather anterior, of soft rays only. Pectorals and ventrals present. Anal fin moderate or long. Caudal forked. Skeleton weakly ossified. Air-bladder small or wanting. Intestinal canal short. Sides sometimes with phosphorescent spots. Eggs inclosed in the sacs of the ovary and extruded through an oviduct. Genera 10, species about 50, mostly inhabiting deep water in warm regions.

(*Scopelidæ* group *Saurina* Günther, v, 393–417.)

*Body without phosphorescent spots. (*Synodontinæ.*)
  a. Teeth not barbed; maxillary not dilated behind; teeth on the palate in a single band on each side ..... Synodus, 130.
**Body with phosphorescent spots. (*Scopelinæ.*)
  b. Body compressed, covered with large, smooth scales ..... Myctophum, 131.

130.—SYNODUS Bloch & Schneider.

Lizard-fishes.

(*Saurus* Cuvier, 1817.)

(Gronovius; Bloch & Schneid. Ichth. 1801, 396: type *Esox synodus* L.)

Body oblong or elongate, nearly terete. Head depressed, the snout triangular, rather pointed. Interorbital region transversely concave.

Mouth very wide; premaxillary not protractile, very long and strong, more than half the length of the head; maxillary closely connected with it, very small or obsolete. Premaxillary with one or two series of large, compressed, knife-shaped teeth, the inner and larger depressible. Palatine teeth similar, smaller, in a single broad band. Lower jaw with a band of rather large teeth, the inner and larger teeth depressible; a patch of strong, depressible teeth on the tongue in front, and a long row along the hyoid bone. Jaws nearly equal. Eye rather large, anterior. Supraorbital forming a projection above the eye. Pseudobranchiæ well developed. Gill-rakers very small, spine-like. Gill-membranes slightly connected. Top of head naked. Cheeks and opercles scaled like the body. Body covered with rather small, adherent, cycloid scales. Lateral line present. No phosphorescent spots. Dorsal fin short, rather anterior. Pectorals moderate, inserted high. Ventrals anterior, not far behind pectorals, large, the inner rays longer than the outer. Anal short. Caudal narrow, forked. Branchiostegals 12–16. Stomach with a long, blind sac and many pyloric cœca. Skeleton rather firm. Species numerous. Voracious fishes of moderate size, inhabiting sandy bottoms at no great depth. In most warm seas. (*συνόδους*, ancient name of some fish, from *συνόδους*, teeth meeting, not shutting past each other like scissors.)

* Snout rather pointed, longer than eye; upper jaw the longer. (*Synodus.*)

463. S. fœtens (L.) Gill.—*Sand Pike; Lizard-fish.*

Olivaceous; yellowish below; back mottled; upper surface of head brownish, distinctly vermiculated with yellowish; ventral fins, lower side of head, and inside of mouth tinged with yellow. Eye moderate, $5\frac{1}{2}$ in head. Scales less regularly arranged and the rows less oblique than in *S. lucioceps;* those on the opercle in about 5 rows, on the cheeks in 7; 25–30 scales along back before dorsal, 4 in a vertical row between adipose fin and lateral line, 5 in an oblique row. Pectoral fin short, not reaching ventrals, its length three-fourths that of the premaxillary. Ventral large, its length from outer edge of base greater than from tip of snout to upper edge of gill-opening. Interorbital space considerably concave, with radiating ridges. Head $4\frac{1}{4}$. B. 12; D. 11; A. 11; V. 8; scales 7–64–8 (the vertical rows counted obliquely). L. 12 inches. Cape Cod to South America; common southward. Not valued as food.

(*Salmo fœtens* L. Syst. Nat.: *Saurus fœtens* Günther, v, 396: *Saurus fœtens* Holbrook, Ichth. S. Car. 187.)

464. S. lucioceps (Ayres) Gill.

Olive-brown above, grayish below, with some golden lustre on sides; back with slaty reticulations; head not vermiculated above; lower side of head and ventral fins yellow. Eye 5 in head. Scales arranged in regular, very oblique rows; those on the opercles in about 8, on the cheeks in about 9 rows; 40–50 scales along the back before the dorsal, 6 in a vertical row between adipose fin and lateral line, and 10 in an oblique row. Pectoral fin longer, reaching base of ventrals, its length about equal to that of the premaxillary. Ventral fin not so long as the space between snout and upper edge of gill-opening. Interorbital space little concave, nearly smooth. Head 4; depth $8\frac{1}{4}$. D. 11; A. 12; B. 14; scales 13–66–16 (the vertical series counted obliquely). L. 12 inches. San Francisco to Mexico; rather common in summer.

(*Saurus lucioceps* Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 66: *Saurus lucioceps* Günther, v, 397.)

** Body rather stout; snout short, obtuse, shorter than eye; lower jaw the longer. (*Trachinocephalus* Gill.*)

465. S. myops (Forster) Jor. & Gilb.

Grayish, mottled or barred; scapula black. Body moderately elongate, tapering backwards. Mouth very large, maxillary more than half length of head; snout shorter than eye; lower jaw somewhat projecting; top of head corrugated; interorbital space concave. Anal fin comparatively long. Ventral fins very long, reaching about to the vent. Head $3\frac{2}{3}$ in length; depth about 5. D. 11; A. 14; scales 4–58–7. Tropical seas; not common on our South Atlantic coast.

(*Salmo myops* Forster, MSS. Bloch & Schneider, 421: *Saurus myops* Günther, v, 398.)

131.—MYCTOPHUM Rafinesque.

(*Scopelus* Cuvier, 1817.)

(Rafinesque, Indice d'Ittiologia Siciliana, 1810: type *Myctophum punctatum* Raf.)

Body oblong, compressed, covered with large cycloid scales, those of the lateral line sometimes enlarged. A series of round luminous spots along the lower side of the head and body. Head compressed. Mouth large, the jaws usually about equal; premaxillary very long, slender; maxillary well developed. Teeth in villiform bands on jaws, palatines, pterygoids, and tongue. Eye large. Gill-rakers very long and slender. Branchiostegals 8–10. Pseudobranchiæ large. Air-bladder small. Py-

*Gill, Cat. Fish. East Coast N. Amer. 1861, 53, no description: type *Salmo myops* Forster. (τραχινος, Trachinus; κεφαλή, head.)

loric cœca few. Dorsal fin near the middle of the body; ventrals usually below it, with 8 rays; pectorals well developed; adipose fin small; anal usually long. Small fishes of the open seas in most regions; species numerous. Several undescribed species have been lately taken off our Atlantic coast by the U. S. Fish Commission. (νύξ, night; φως, light; hence amended by Cocco to *Nyctophus*.)

466. M. crenulare Jordan & Gilbert.

Body much compressed, deepest in front of the base of the pectorals, bluntly convex anteriorly, tapering behind. Ventral region much more arched than dorsal. Caudal peduncle long and very slender. Head short and high, abruptly rounded in profile, the snout very blunt. Jaws equal, the snout not projecting beyond the mouth. Maxillary very slender, scarcely widened to its tip, and not dilated, its extremity reaching beyond the eye to the margin of the preopercle. Premaxillaries anteriorly on a level of the pupil. Teeth very small, present on all the dentigerous bones. Rami of the mandible nearly parallel, coming together in a sharp keel below. Orbital margin above and in front with a thin membranaceous rim, that in front distinct and formed by the upturned edge of the preorbital. No orbital spine. Nasal bones membranaceous, their edges upturned, forming a horizontal groove. A groove between the frontal bones. Orbital margins separated by a groove from the preopercle. Margin of preopercle very oblique. All the membrane bones extremely thin, papery. Eye large, $3\frac{1}{3}$ in head. Gill-rakers long and slender. Head $3\frac{3}{4}$ in length to base of caudal; depth $4\frac{1}{2}$. Head and body completely covered with thin membranaceous scales, those on the middle of the sides not elevated and not noticeably larger than the others. Free edges of all the scales crenulate, some of them, especially on the back, with the crenations acute, but without spines, the scales being truly cycloid. About 45 scales in a longitudinal series. A phosphorescent spot on each mandible near the symphysis, 33 pairs of spots along the belly, 6 in front of ventrals, 6 between ventrals and origin of anal, and 21 between front of anal and base of caudal. Caudal peduncle above and below with two or three backward-directed spines, which are apparently the exserted tips of vertebral processes. D. 12; A. 16; the fins rather low. Origin of dorsal nearer the snout than the base of caudal, much behind the base of the ventrals. Ventrals short, not reaching half way to vent. Pectorals reaching base of ventrals. Color very dark steel-blue above, silvery on sides and below, with dark metallic lustre; the

usual phosphorescent spots present, as above described; no evident cream-colored blotch on the back of tail. L. 2½ inches. Santa Barbara Channel, California.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 274.)

467. M. glaciale (Reinh.) J. & G.

Snout very short and obtuse, with the upper profile descending in a very strong curve; cleft of mouth oblique; maxillary reaching to the angle of the præoperculum, and terminating in a triangular dilatation. Scales smooth, those of the lateral line enlarged. Eye very large, more than one-third the length of head, which is nearly as deep as long. Depth 4, nearly equal to length of head. D. 13; A. 17; V. 8. Lat. l. 36. Coasts of Scandinavia and Greenland. (*Günther.*)

(*Scopelus glacialis* Reinhardt, Dansk. Vidensk. Selsk. 1838, vii, 115, 126: *Scopelus glacialis* Günther, v, 407.)

Family XLIII.—STERNOPTYCHIDÆ.

(*The Sternoptychids.*)

Body oblong or ovate, naked. Mouth very wide, its cleft oblique or vertical. Margins of upper jaw formed laterally by the maxillaries, the edges of which are toothed. Teeth pointed, mostly small. Opercular apparatus incomplete. Gill-openings very wide, the membranes not connected, free from the isthmus. Pseudobranchiæ present. Gill-rakers long or short. Lower part of body and head with series of phosphorescent spots. Adipose fin present, often small. Dorsal fin moderate, usually median, sometimes preceded by a rudimentary spinous dorsal. Eggs extruded through oviducts. Skeleton imperfectly ossified. Small fishes of the deep seas. Genera 4; species about 12.

(*Sternoptychidæ* groups *Sternoptychina* and *Cocciina* Günther, v, 384–391.)

*No scales; no rudimentary spinous dorsal; pseudobranchiæ present. (*Cocciinæ.*)
† Lower jaw prominent..... .....Maurolicus, 132.

132.—MAUROLICUS Cocco.

Argentines.

(Cocco, Lettere sui Salmoni, 32: type *Maurolicus amethystinopunctatus* Cocco.)

Body oblong, compressed, naked, covered with silvery pigment; series of phosphorescent spots along the lower side of the head, body, and tail. Head compressed, the bones thin, but ossified. Cleft of mouth wide, oblique, the lower jaw prominent. Maxillary large, broad, much produced backwards, receiving the slender premaxillary in the upper

concave part of its margin. Both jaws with minute teeth. Gill-rakers very long. Pectorals and ventrals developed. Dorsal well back, but before anal. Adipose fin rudimentary. Anal fin long. Branchiostegals 8 or 9. Size small. Species about 4. (Dedicated to Maurolico, an Italian naturalist.)

*Phosphorescent organs appearing as impressions on the skin.

468. M. borealis (Nilss.) Günther.

Dark greenish, sides silvery. Body compressed. Mouth wide, the lower jaw much projecting. Teeth small. Eye large, 3 in head. Five luminous spots on the throat, 12 between pectorals and ventrals, above these a row of 8, 5 between ventrals and anal, vent to tail 24. Dorsal nearer tail than snout. Adipose fin very small. Ventrals below dorsal. Caudal forked. Head $3\frac{1}{2}$; depth $3\frac{1}{4}$. D. 10; A. 15. L. $2\frac{1}{4}$ inches. (*Storer.*) North Atlantic; rare off our coasts.

(*Scopelus borealis* Nilsson, Observ. Zool. 9; Günther, v, 389: *Scopelus humboldti* DeKay, N. Y. Fauna, Fish. 246: *Scopelus humboldti* Storer, Hist. Fish. Mass. 328 (not of Cuvier).

FAMILY XLIV.—CHAULIODONTIDÆ.

(*The Chauliodonts.*)

Body oblong or elongate, compressed, covered with rather large, thin, deciduous scales. Lateral line present. No barbels. Series of phosphorescent spots running along the lower side of the head, body, and tail. Head much compressed, the bones thin, but ossified. Mouth with the cleft extremely wide, its margins formed by maxillaries and premaxillaries, both of which are provided with teeth. Teeth unequal, some of them long and pointed, fang-like. Pectorals and ventrals well developed. Adipose fin present. Caudal forked. Gill-openings very wide. No pseudobranchiæ. No air-bladder. Deep waters of the Atlantic. Genera 2, *Gonostoma* and *Chauliodus*, differing widely in the position of the dorsal, the size of the anal, and the development of the gill-rakers; 2 species are known.

(*Sternoptychidæ* group *Chauliodontina* Günther, v, 391, 392.)

*Dorsal in front of ventrals; no gill-rakers; anal with less than 20 rays.

CHAULIODUS, 133.

133.—CHAULIODUS Bloch & Schneider.

Viper-fishes.

(Bloch & Schneider Syst. Ichth. 1801, 430: type *Chauliodus sloani* Bloch & Schneider.)

Body elongate, compressed, covered with very thin deciduous scales of moderate size. Head short, much compressed and elevated, the

lower jaw projecting, the snout much shorter than eye. Mouth extremely wide, the cleft reaching much beyond eye. Premaxillaries with four long fang-like canines on each side. Mandible with pointed, wide-set teeth, the anterior ones excessively long; none of these large teeth received within the mouth. Maxillaries with fine teeth; palatine with a single series of small pointed teeth; no teeth on the tongue. Eye moderate. Pectorals moderate. Ventrals large. Dorsal fin high, placed anteriorly, well in front of the ventrals. Adipose fin moderate, sometimes fimbriate, opposite the low, short anal. Caudal moderate, forked. Gill-openings very wide. No gill-rakers. Branchiostegals numerous. (*χαύλιος*, exserted; *ὀδούς*, tooth.)

469. C. sloani Bloch & Schneider.

Greenish above; sides silvery; belly blackish. Dorsal not far behind head, its first ray produced in a long filament. Pectoral fins short. Ventral fins elongate, longer than head. About 30 phosphorescent dots in a series from the chin to the ventrals. Scales of the body subhexagonal. Head nearly as deep as long, 7 in total length; depth about the same. B. 17; D. 6; A. 12; V. 7; Lat. l. 56. L. 12 inches. (*Günther.*) Mediterranean and deep waters of the Atlantic; a specimen found in the stomach of a cod on George's Banks.

(Bloch & Schneider, 430; Günther, v, 392.)

Family XLV.—STOMIATIDÆ.

(*The Stomiatoids.*)

Body elongate, naked or covered with thin deciduous scales. Mouth very wide. Lateral margin of upper jaw formed by the maxillaries, which are provided with teeth along their edges. Teeth usually very strong, unequal, some of them often fang-like. Gill-membranes not joined, free from the isthmus. Branchiostegals numerous. A long fleshy barbel suspended from the throat. No pseudobranchiæ. Sides with phosphorescent spots. Dorsal fin short, median or posterior, without spines. Adipose fin present or absent. Pectorals and ventrals present. Opercular apparatus incomplete. Skeleton feebly ossified. Eggs excluded through oviducts. Deep-sea fishes of the Atlantic. Genera 4; species 8 or 10.

(*Stomiatidæ* Günther, v, 424.)

* No adipose fin; dorsal opposite anal. (*Stomiatinæ.*)

a. Body with fine deciduous scales ..... Stomias, 134.

aa. Body naked.

b. Vomer and palatines with teeth.....ECHIOSTOMA, 135.
bb. Vomer and palatines toothless.....MALACOSTEUS, 136.
** Adipose fin present; dorsal in front of anal; body naked. (*Astronesthinæ.*)
ASTRONESTHES, 137.

134.—STOMIAS Cuvier.

(Cuvier, Règne Anim. ii, 1817: type *Esox boa* Risso, from the Mediterranean.)

Body elongate, compressed, covered with exceedingly fine and deciduous scales, which are scarcely imbricated, lying in subhexagonal depressions in the skin. Head compressed, the snout very short and the cleft of the mouth extremely large. Mouth oblique, the lower jaw projecting. Teeth pointed, unequal, those of the premaxillaries and mandible very large; maxillary with fine teeth; vomer with a pair of fangs; palatines and tongue with smaller pointed teeth. Eye moderate. Opercular portion of the head short; a large fleshy barbel suspended from the hyoid region. Vent far back. Dorsal comparatively long, far back, opposite the anal. Pectorals and ventrals rather small and short, the latter far back. Caudal fin moderate. Lower side of head, body, and tail with series of phosphorescent dots. Gill-openings very wide. No pyloric cœca. Singular fishes of the deep waters of the Atlantic.
(*στόμιας*, "mouthy," from *στόμα*, mouth.)

* Hyoid barbel not fringed.

470. S. ferox Reinhardt.

Black. Neither pectorals nor ventrals produced. Caudal rounded. Depth about 12 in total length; head 10. D. 17; A. 21; P. 6; V. 6. (*Günther.*) Greenland, south to Cape Cod, in deep water.

(Reinhardt, Vidensk. Selsk. Naturv. etc. x, p. lxxvii; Günther, v, 426.)

135.—ECHIOSTOMA Lowe.

(Lowe, Proc. Zoöl. Soc. Lond. 1843, 87: type *Echiostoma barbatum* Lowe.)

Body elongate, compressed, scaleless. Head rather compressed, the snout short and the cleft of the mouth very wide. Teeth pointed, unequal, those of the premaxillary and the front of the lower jaw being longest; maxillary teeth in a single series, those of the lower two-thirds being small; teeth of the hinder part of the mandible in a double or triple series; vomer with a pair of fangs; palatines with a single series of small pointed teeth; two groups of similar teeth on the tongue. Eye of moderate size. Opercular portion of the head very narrow and flexible; a fleshy barbel on the centre of the hyoid region. Dorsal fin far back, opposite anal. Caudal forked. Vent not far in advance of caudal fin. Pectorals and ventrals feeble, the latter behind the middle of the

body. Series of phosphorescent dots along the lower side of the head, body, and tail. Gill-openings very wide. Gill-rakers minute. No pseudobranchiæ. No air-bladder. Atlantic. (ἔχις, a viper; στόμα, mouth.)

471. E. barbatum Lowe.

Black, with an elongate, club-shaped (phosphorescent) rose-colored spot between the maxillary and the eye. Barbel as long as head (in specimens seen), fringed at its tip. "Upper ray of pectoral produced in a long and slender filament reaching nearly to the root of the ventrals" (wanting in specimens examined). Ventrals narrow, elongate. Head 6 in length; depth 9. B. 12; D. 12–15; A. 17; P. 3–5; V. 8. L. 9 inches. Deep waters of the Atlantic; lately taken off Gloucester, Mass.

(Lowe, Proc. Zoöl. Soc. Lond. 1843, 88; Günther, v. 427; Goode & Bean, Bull. Essex. Inst. 1879, 23.)

136.—MALACOSTEUS Ayres.

(Ayres, Journ. Bost. Soc. Nat. Hist. 1849, 53: type *Malacosteus niger* Ayres.)

Body elongate, compressed, scaleless. Head rather compressed, the snout very short, the cleft of the mouth very wide, extending to behind the root of the pectorals. Teeth pointed, unequal, in single series on both jaws and tongue; none on the palate. Opercula membranaceous. Dorsal far back, opposite anal. Pectorals rudimentary. Ventrals rather posterior. One species known. (μαλακός, soft; ὀστέον, bone.)

472. M. niger Ayres.

Black, with a white loral spot. Snout very short, convex. Lower jaw with very long canines. Barbel long and slender. Pectoral rays coalescing into a thin, long filament. Ventrals filamentous. Head $3\frac{3}{4}$ with caudal; depth 6. D. 19; A. 20; P. 5; V. 6. North Atlantic; a single specimen known. (*Ayres.*)

(Ayres, l. c.; Gunther, vi, 427.)

137.—ASTRONESTHES Richardson.

(Richardson, Ichth. Voy. Sulph. 97, 1845: type *Astronesthes nigra* Rich.)

Body rather elongate, compressed, scaleless. Head compressed, the snout short, the mouth wide. Teeth pointed, unequal. Upper jaw with four long, curved canines; lower with two; maxillary teeth fine, subequal; palatines with a single series of small, pointed teeth, similar to those on tongue. Eye moderate. Throat with a barbel. Dorsal fin long, inserted in front of anal, behind ventrals; adipose fin present; caudal forked; paired fins well developed. Gill-rakers minute. No pseudobranchiæ. No air-bladder. Lower parts with phosphorescent spots. (ἄστρον, star (star-fish); εσθιω, to eat.)

473. A. niger Rich.

Black, with about 22 luminous spots between chin and ventrals. Barbel a little longer than head. Dorsal beginning just behind base of ventrals; pectoral not reaching nearly to ventrals. Jaws equal. Eye large, well forward. Head 4; depth 5½. D. 17; A. 14. Deep waters of the Atlantic; described from specimens from the Grand Banks, perhaps belonging to a different species.

(Richardson, Ichth. Voy. Sulph. 97; Günther, v, 425.)

Family XLVI.—SALMONIDÆ.

(*The Salmon Family.*)

Body oblong or elongate, covered with cycloid scales. Head naked. Mouth terminal, varying much in size and form; maxillary forming the lateral margin of the upper jaw, provided with a supplemental bone; premaxillaries not protractile. Teeth various, sometimes wanting. Gills 4, a slit behind the fourth. Pseudobranchiæ present, but often small or rudimentary. Gill-rakers various. Gill-membranes not connected free from the isthmus. Branchiostegals 3–20. No barbels. Dorsal usually nearly median, not greatly elongate. Adipose fin present. Caudal fin forked. Anal fin moderate or rather long. Ventrals moderate, nearly median. Pectorals placed low. Lateral line present. Abdomen rounded. Air-bladder large. Stomach cœcal or siphonal; the pyloric cœca few or many, sometimes obsolete. Ova generally large, falling into the cavity of the abdomen before exclusion. Genera about 20; species 125. A large and varied family; its members inhabit chiefly the fresh waters of northern regions, many of them being anadromous, running up from the sea to spawn in the rivers. One genus (*Retropinna*) is found in New Zealand, and the species of *Microstoma*, *Argentina*, and *Hyphalonedrus* are mostly deep-sea fishes. In economic importance this family ranks among the very first, and the salmon and trout in all northern regions are the choicest prizes of the angler.

(*Salmonidæ* Günther, vi, 1–205.)

* Pyloric cœca few or none; stomach cœcal.

† Dorsal fin nearly over the ventrals. (*Argentininæ.*)

a. Branchiostegals 3 or 4; body elongate, subcylindrical .... MICROSTOMA, 138.

aa. Branchiostegals 6-8; body compressed.

b. Adipose fin long and low, scarcely shorter than dorsal fin.

MALLOTUS (juv.)

bb. Adipose fin normal, short and high.

c. Ventrals inserted in front of the middle of the dorsal; mouth large.

d. Scales very small; males with villous bands; teeth feeble; pectoral rays 16–20 ..... MALLOTUS, 140.

dd. Scales larger, similar in both sexes; pectoral rays 10–12.
e. Teeth feeble, those on tongue very weak; scales small, adherent.
THALEICHTHYS, 141.
ee. Teeth stronger, those on tongue enlarged; scales moderate, deciduous..... OSMERUS, 142.
cc. Ventrals inserted under or behind the middle of dorsal; mouth moderate or small.
f. Scales cycloid.
g. Jaws with minute teeth; maxillary reaching past front of eye.
HYPOMESUS, 143.
gg. Jaws toothless; maxillary not reaching front of eye.
ARGENTINA, 144.
ff. Scales ctenoid ..... HYPHALONEDRUS, 145.
** Pyloric cœca many; stomach siphonal.
‡ Jaws toothless or with a few feeble asperities; scales rather large; anal fin somewhat elongate; maxillary short and broad; not anadromous (*Coregoninæ*)..... COREGONUS, 146.
‡‡ Jaws with distinct teeth; scales mostly small. (*Salmoninæ.*)
h. Dorsal fin very long and high, of about 20 rays; scales moderate; tongue toothless; not anadromous.
THYMALLUS, 147.
hh. Dorsal fin moderate, its rays 9–15 in number; tongue with teeth.
i. Dentition very feeble, incomplete; anal fin elongate, of about 17 rays; scales moderate; not anadromous.
STÉNODUS, 148.
ii. Dentition strong and complete; conical teeth on jaws, vomer, and palatines; tongue with two series of strong teeth (deciduous in very old specimens of *Oncorhynchus*); scales small.
j. Anal fin elongate, of 14-17 rays; vomer narrow, long, flat, with weak teeth; species black spotted.
ONCORHYNCHUS, 150.
ij. Anal fin short, of 9–11 developed rays.
k. Vomer flat, its toothed surface plane; teeth on the shaft of the vomer in alternating rows or in one zigzag row, those on the shaft placed directly on the surface of the bone, not on a free crest (posterior vomerine teeth sometimes deciduous); species black spotted.... SALMO, 151.
kk. Vomer boat-shaped, the shaft strongly depressed, without teeth; very small, about 200 in the course of the lateral line; species not anadromous, spotted with red or gray..... SALVELINUS, 152.

138.—MICROSTOMA Cuvier.

(Cuvier, Règne Anim. ii, 1817: type *Gasteropelecus microstoma* Risso = *Microstoma rotunâatum* Risso.)

Body elongate, cylindrical, covered with large, thin, silvery scales. Head short. Mouth very small, terminal; premaxillaries very small; maxillaries very short and broad, not extending to the front of the very large eye, which forms more than half the depth of the side of the head. Lower jaw and vomer with a narrow series of fine teeth; no other teeth. Dorsal fin short, inserted before or behind the ventrals, which are behind

the middle of the body; anal fin small; caudal small, forked, its central part scaly; pectoral rather narrow; adipose fin small, fringed, present in the young, but usually disappearing with age. Branchiostegals 3 or 4. Pseudobranchiæ well developed. Air-bladder large, silvery. No pyloric cœca; mucous membrane of stomach papillose. Atlantic Ocean, in deep waters. (*μικρός*, small; *στόμα*, mouth.)

474. M. grœnlandicum Reinh.

"This fish appears to be intermediate between *Argentina* and *Microstoma*, having the dorsal fin inserted for the greater part in advance of the ventrals, and a series of fine teeth in the lower jaw. Teeth on the vomer, none on the tongue. Adipose fin conspicuous. The height of the body is one-half the length of the head and one-tenth of the total." B. 3; D. 11; A. 10; V. 10. (*Günther.*) Greenland.

(*Microstomus grönlandicus* Reinh. Vidensk. Selsk. Naturv. Mathem. Afhandl. viii, 1841, lxxiv; Günther, vi, 205.)

139.—MALLOTUS* Cuvier (*young*).

Form and dentition of *Thaleichthys*. No trace of scales in the known examples, which are immature. Dorsal fin well backward over ventrals, its insertion nearer the tip of the caudal than the snout; adipose fin long and low, its height much less than the length of its base, its base little shorter than that of the dorsal; pectoral rays in increased number; anal moderate. Pseudobranchiæ well developed. Branchiostegals 9. Pyloric cœca 4.

473. M. villosus (Müller) Cuvier (*young*).

Translucent whitish; a silvery lateral stripe; upper regions closely punctate. Eye a little shorter than snout, 4 in head. Minute teeth in both jaws; middle of tongue rough; maxillary reaching front of pupil. Ventrals and pectorals about equal in length to the longest dorsal ray, which is 7 times in length of body; ventrals inserted below first ray of dorsal, not reaching vent; space between dorsal and adipose fin two-thirds length of head; length of adipose fin more than twice its height, two-thirds base of anal. Head 4; depth 6. D. 12; A. 21; V. 8; P. 16. L. 4 inches. Behring's Straits. Probably developed scales when adult.

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*As these pages are passing through the press, we learn from Dr. Bean that the fish here described, collected by him in Behring's Straits, is not a distinct genus and species as at first supposed, but the young of *Mallotus villosus*. We therefore suppress the proposed generic and specific names, letting the description remain, it being too late to cancel the latter.

140.—MALLOTUS Cuvier.

Capelins.

(Cuvier, Règne Anim. 1829, ed. 2, ii: type *Clupea villosa* Müller.)

Body elongate, compressed, covered with minute scales, a band of which, above the lateral line and along each side of the belly, are enlarged, and in mature males they become elongate-lanceolate, densely imbricated, with free, projecting points, forming villous bands. In very old males the scales of the back and belly are similarly modified, and the top of the head and the rays of the paired fins are finely granulated. Mouth rather large, the maxillary thin, extending to below the middle of the large eye. Teeth minute, forming single series on the jaws, vomer, palatines, and pterygoids; lingual teeth somewhat enlarged, in an elliptical patch. Lower jaw projecting. Dorsal inserted over ventrals. Branchiostegals 8–10. Lower fins very large. Pectoral fins large, horizontal, with very broad base, their rays in increased number (16–20). Pseudobranchiæ quite small. Gill-rakers long, slender. Pyloric cœca 6, small. Ova very small. Marine species of the North Atlantic and Pacific. (*μαλλωτὸς*, villous.)

476. M. villosus (Müller) Cuvier.—*Capelin.*

Dusky olivaceous above, grayish silvery on sides and below. Head long, pointed. Base of anal in males compressed and prominent; pectorals reaching more than half way to ventrals, the latter to anal. Eye large, 3½ in head. Head 4½ in length; depth about 6. D. 12; A. 18. Lat. l. *ca.* 150. Greenland to Cape Cod and Alaska; abundant northward.

(*Clupea villosa* Müller, Prodr. Zoöl. Dan. 1777, 245; Günther, vi, 170.)

141.—THALEICHTHYS Girard.

Eulachon.

(Girard, U. S. Pac. R. R. Surv. Fish. 1859, 325: type *Thaleichthys stevensi* Grd. = *Salmo pacificus* Rich.)

This genus is intermediate between *Mallotus* and *Osmerus*, differing from the latter in its rudimentary dentition. All the teeth are very feeble, slender, and deciduous, although occasionally present on all the bones of the mouth. No permanent teeth on the tongue. The scales are much smaller than in *Osmerus*, and more closely adherent; larger than in *Mallotus*, and similar in the two sexes. The coloration is dusky.

Small fishes of the North Pacific, remarkable for their extreme oiliness. When dried they burn like a candle. (*θάλεια*, rich; *ἰχθύς*, fish.)

477. T. pacificus (Rich.) Grd.—*Eulachon; Candle-fish.*

Color white, scarcely silvery; upper regions rendered dark iron-gray by the accumulation of dark punctulations. Body rather elongate, slender, and less compressed than in *Osmerus*. Head long, blunter than in *Hypomesus pretiosus*, less compressed, broader, and more convex above. Mouth large, the maxillary rather narrow and long, reaching beyond the middle of the rather small eye; lower jaw projecting. Opercle with strong concentric striæ. Gill-rakers numerous, rather long and slender. Ventrals large, inserted just in front of dorsal. Pseudobranchiæ small. Head $4\frac{3}{4}$; depth 6. B. 8; D. 11; A. 21; P. 11. Lat. l. 75; pyloric cœca 11; vertebræ 70. L. 12 inches. Oregon to Alaska, ascending the rivers in enormous numbers in the spring. An excellent pan-fish, unsurpassed in delicacy of flesh.

(*Salmo* (*Mallotus*?) *pacificus* Richardson, Fauna Bor.-Amer. iii, 226: *Thaleichthys stevensi* Girard, U. S Pac. R. R. Surv. Fish. 325; Günther, vi, 168.)

142.—OSMERUS Linnæus

Smelts.

(Artedi; Linnæus, Syst. Nat.: type *Salmo eperlanus* L.)

Body elongate, compressed. Head long, pointed. Mouth wide, the slender maxillary extending to past the middle of the eye; lower jaw projecting. Preorbital and suborbital bones narrow. Maxillaries and premaxillaries with fine teeth; lower jaw with small teeth, which are larger posteriorly; tongue with a few strong, fang-like teeth, largest at the tip; hyoid bone, vomer, palatines, and pterygoids with wide-set teeth. Gill-rakers long and slender. Branchiostegals 8. Scales large, loose, 60–70 in the course of the lateral line. Dorsal small, about midway of the body, over the ventrals; anal rather long. Vertebræ about 60. Pyloric cœca small, few. Small fishes of the coasts of Europe and Northern America, sometimes ascending rivers. They are considerably valued as food. (*ὀσμηρός*, odorous; the name is equivalent to the English "smelt".)

a. Vomer with a cross-series of small teeth; species spawning in the sea.

478. O. thaleichthys Ayres.

Olivaceous, sides silvery and somewhat translucent. Body comparatively deep and compressed. Head rather short and deep, the maxil-

lary broad, its edge strongly curved, extending to opposite posterior margin of pupil. Premaxillary on the level of upper part of pupil. Mandible projecting, its tip somewhat curved upward. Eye longer than snout, 4 in head. Fins high, the pectorals usually reaching ventrals, and the ventrals to anal; anal reaching about to caudal. Teeth weak; maxillary teeth scarcely visible. Head $4\frac{1}{2}$; depth $5\frac{1}{2}$. D. 9; A. 18; P. 11. Lat. l. 60. L. 9 inches. Pacific coast from San Francisco northward; rather common.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 62; Günther, vi, 168.)

479. O. attenuatus Lockington.

Greenish, sides silvery. Body elongate, compressed. Head rather long, somewhat pointed; maxillary extending past pupil; lower jaw projecting; maxillary rather narrow, little convex. Outline of both jaws nearly straight, less curved than in *O. thaleichthys*. Teeth on tongue strong, but much smaller than in *O. mordax;* teeth on maxillary conspicuous; front of both jaws with rather strong teeth; palatine teeth variable, usually strong. Eye large, 4 in head. Fins low. Pectorals not reaching ventrals, nor ventrals anal, nor anal to caudal. Head $4\frac{1}{5}$; depth 6. D. 10; A. 15–17; P. 11. Lat. l. 65. L. 10 inches. Coast of California; not rare. Very close to *O. thaleichthys*, but probably distinct.

(Lockington, Proc. U. S. Nat. Mus. 1880, 66.)

aa. Vomer with 2–4 strong fang-like teeth; species ascending rivers.

480. O. mordax (Mitch.) Gill.—*American Smelt.*

Transparent greenish above, silvery on sides; body and fins with some dark punctulations. Body rather long and slender. Head large, with large mouth and stronger teeth than in the other species of the genus. Small teeth along the edge of the maxillary; strong fang-like teeth on tongue and front of vomer; cardiform teeth on palatines, pterygoids, and hyoid bone; mandible with moderate teeth, its tip projecting. Scales deciduous. Dorsal fin rather posterior, the ventrals under its front. Lower fins moderate, none reaching the next behind it. Gill-rakers two-thirds diameter of eye. Head 4; depth $6\frac{1}{2}$. D. 10; A. 15; P. 13. Lat. l. 68. L. 12 inches. Atlantic coast from Virginia northward, entering streams and often land-locked. Very close to the European *O. eperlanus*, but the latter has larger scales (Lat. l. 60), shorter gill-rakers, and rather weaker teeth.

(*Atherina mordax* Mitchill, Trans. Lit. & Phil. Soc. N. Y. 1814, 446: *Osmerus viridescens* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 230: *Osmerus viridescens* Günther, vi, 167.)

Var. **spectrum** Cope.—*Wilton Smelt.*

Slender. Head short, with very large eye, and short mouth and maxillary. Maxillary not extending beyond middle of pupil. Eye 3 in head. Head $4\frac{1}{4}$; depth $8\frac{1}{3}$. D. 10; A. 15; Lat. l. 66. L. transv. 10. Small. Wilton Pond, Kennebec County, Maine; land-locked in fresh water. (*Cope.*)

(*Osmerus spectrum* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 490.)

Var. **abbotti** Cope.—*Cobessicontic Smelt.*

Stouter. Eye smaller. Maxillary reaching posterior margin of pupil. Eye $4\frac{1}{2}$ in head. Head $4\frac{3}{4}$; depth 7. Lat. l. 68. L. transv. 16. Land-locked in Cobessicontic Lake, Kennebec County, Maine. (*Cope.*)

(*Osmerus abbotti* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 490.)

481. O. dentex Steindachner.

Dark brown above; sides silvery or golden; head and body with dark points. Eye two-thirds length of snout. Teeth as in *O. eperlanus* and *O. mordax;* maxillary reaching posterior margin of eye, its length five times in distance from tip of lower jaw to dorsal. Height of dorsal half length of head; height of anal two-sevenths. Head 4; depth $5\frac{1}{2}$. D. 10; A. 13; V. 8; Lat. l. 66; L. transv. 16. Port Clarence, Alaska, to northern China. (*Bean*, MSS.)

(Steindachner, Sitzungsb. Kais. Akad. Wiss. Wien, lxi, 1870, 429.)

143.—HYPOMESUS Gill.

Surf Smelts.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 169: type *Argentina pretiosa* Grd.)

Body rather elongate, moderately compressed, covered with thin scales of moderate size. Head rather pointed. Mouth moderate, formed as in *Argyrosomus*, the shortish maxillary not extending quite to middle of eye; its outline below broadly convex, lower jaw projecting. Teeth minute, on jaws, vomer, palatines, pterygoids and tongue. Ventrals inserted directly under middle of dorsal, midway between eye and base of caudal. Branchiostegals 6–7. North Pacific. (ὑπό, below; μέσος, middle; in allusion to the position of the ventrals.)

482. H. pretiosus (Grd.) Gill.—*Surf Smelt.*

Light olivaceous; a silvery band along the lateral line. Eye as long as snout, $4\frac{1}{2}$ in head. Fins low, the longest dorsal ray 8 in length, without caudal; pectorals scarcely reaching half way to ventrals, 7

in length of body; ventrals not reaching vent, their length 8⅓ in body. Head 4½; depth 4¾. D. 10; A. 15; P. 14; V. 8; Lat. l. 70. L. 12 inches. Pacific coast, from California northward; abundant, spawning in the surf. A very firm-fleshed and fat little fish, scarcely inferior to the eulachon.

(*Argentina pretiosa* Grd. Proc. Acad. Nat. Sci. Phila. 1854, 155: *Osmerus pretiosus* Girard, U. S. Pac. R. R. Surv. Fish. 324: *Osmerus elongatus* Ayres, Proc. Acad. Nat. Sci. Phila. 1854, 17.)

483. H. olidus (Pallas) Günther.

Darker. Fins higher, the longest dorsal ray 6 in length of body; pectorals reaching two-thirds the distance to root of ventrals, their length 5 in body; ventrals 6 in length of body. Lat. l. 56–60. Alaska and Kamtschatka, spawning in fresh-water ponds. (*Bean*, MSS.)

(*Salmo* (*Osmerus*) *olidus* Pallas, Zoogr. Ross. As. iii, 391; Günther, vi, 169, in part.)

144.—ARGENTINA Linnæus.

Argentines.

(Artedi; Linnæus, Syst. Nat.: type *Argentina sphyræna* L.)

Body oblong, covered with rather large cycloid scales, which are often rough with spinous points. Mouth small, the maxillaries very short, not reaching to the eye. Eye very large. Jaws toothless; an arched series of minute teeth on the head of the vomer and on the fore part of the palatine; tongue typically, with a series of small curved teeth on each side. Dorsal fin short, in advance of the ventrals. Caudal fin deeply forked. Eggs small. Fishes of the deep waters of the North Atlantic and Mediterranean, never entering fresh waters. (Latin *argentum*, silver.)

* Scales more or less rough. (*Silus* Reinhardt.*)

484. A. syrtensium Goode & Bean.

Body compressed. Head not quite twice as long as deep. Snout nearly 3½ in head. Insertion of dorsal midway between snout and adipose fin; ventrals under last ray of dorsal. Scales very large, cycloid, covered with minute asperities; a median row of scales along the back and the belly. Color olivaceous; sides silvery. Head 4⅛; depth 5⅓. B. 6; D. 12; A. 13; V. 14; scales 3–60–4. L. 17 inches. Sable Island Bank, in deep water.

(Goode & Bean, Proc. U. S. Nat. Mus. 1878, 261.)

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* Reinhardt, Bemärkn. til den Skand. Ichthyol. 11: type *Salmo silus* Ascanius. (From the Norwegian name *Vas-Sil*, said to mean rough herring.)

145.—HYPHALONEDRUS Goode.

(Goode, Proc. U. S. Nat. Mus. 1880, iii, 483: type *H. chalybeius* Goode.)

Body sub-terete, covered with adherent rough-pectinate or ctenoid scales. Mouth rather large, the maxillary reaching to beyond front of orbit; lower jaw projecting. Teeth on jaws, small, sharp; tongue smooth. Dorsal in front of ventrals. Otherwise essentially as in *Argentina*.. Deep sea. (ὕφαλος, under the sea; ἔνεδρος, dweller.)

485. H. chalybeius Goode.

Grayish, mottled with brown; scales metallic silvery. Body plump, terete. Maxillary broad and flattened posteriorly, extending to front of pupil, its length $2\frac{3}{4}$ in head. Interorbital space broad, 4 times the diameter of eye. Scales arranged in regular transverse rows, overlapping in such a manner as to resemble oblique plates on the sides. Lateral line prominent, straight. Insertion of dorsal midway between pectorals and ventrals, or snout and adipose fin; pectorals long; ventrals under middle of dorsal; caudal forked. Head 4; depth 4. D. 11; A. 8; P. 17 or 18; V. 9 or 10; Lat. l. 52. Deep sea, off the coast of Rhode Island.

(Goode, Proc. U. S. Nat. Mus. 1880, 484.)

146.—COREGONUS Linnæus.

White-fish.

(Artedi; Linnæus, Syst. Nat.: type *Coregonus lavaretus* L.)

Body oblong or elongate, compressed. Head more or less conic, compressed, the form of the snout varying considerably. Mouth small, the maxillary short, not extending beyond the orbit, with a well-developed supplemental bone. Teeth extremely minute, if present. Scales moderate, thin, cycloid, rather firm. Dorsal fin moderate; caudal fin deeply forked; anal fin somewhat elongate; ventrals well developed. Pseudobranchiæ large. Gill-rakers varying from short and thickish to very long and slender. Air-bladder very large. Stomach horseshoe-shaped, with many (about 100) pyloric cœca. Ova small. Species about 40, inhabiting the clear lakes of Northern Europe, Asia, and America, in Arctic regions descending to the sea. Most of them spawn in late fall or winter near the shore, at other seasons often frequenting considerable depths. The group, as here defined, includes a number of sections characterized by minor modifications of structure, some of which have been considered as genera. It seems to us that the number of distinct species has been overestimated by previous writers, and that the geographical range of each one is much wider than has hitherto been

generally supposed. The species are highly valued for food, the flesh being generally pale and of fine flavor. The coloration is very uniform; bluish olivaceous above; the sides and below silvery. (*κόρρη*, the temples; *γώνος*, angle.)

This genus may be subdivided as follows:

* Lower jaw included; premaxillaries broad, placed vertically or the lower edge turned inward.

† Gill-rakers short, thickish, few in number; preorbital broad, wider than pupil; maxillary short and rather broad, not reaching to the line of the eye; the small supplementary bone mostly narrow and sharply elliptical; mouth very small (PROSOPIUM Milner)..... *couesi, williamsoni, quadrilateralis, kennicotti.*

†† Gill-rakers numerous, long, and slender; preorbital long and narrow; maxillary comparatively long, the supplemental bone ovate. (COREGONUS.)

‡ Tongue toothless, or nearly so; back elevated..... *clupeiformis.*

‡‡ Tongue with about three series of small teeth; body elongate, compressed. *labradoricus.*

‡‡‡ Tongue nearly toothless; back not elevated..... *hoyi.*

** Lower jaw projecting; premaxillaries narrow, placed more or less horizontally.

§ Body elongate, subfusiform; scales small, uniform, convex behind (ARGYROSOMUS Agassiz)..... *merki, artedi, nigripinnis.*

§§ Body short, deep, compressed, shad-like; curve of the back similar to that of the belly; scales large, larger forwards, rather closely imbricated, the posterior margin little convex (ALLOSOMUS Jordan) ..... *tullibee.*

* Lower jaw included; premaxillaries broad, placed vertically or turned inward.

† Gill-rakers short, thickish, few in number; preorbital broad, wider than pupil; maxillary short and rather broad, not reaching to the line of the eye; the small supplementary bone mostly narrow and sharply elliptical; mouth very small. (*Prosopium** Milner.)

486. C. couesi Milner.—*Chief Mountain White-fish.*

Head narrowed anteriorly, the snout prolonged, pig-like, protruding beyond the mouth. Maxillary 4 in head, barely reaching eye. Suborbital and supraorbital wider than in the other species. Depth $4\frac{1}{8}$ in length; length of head about the same; body therefore elongate, not elevated nor much compressed. D. 12; A. 10; scales 8–88–7. Chief Mountain Lake, Montana, a tributary of the Saskatchawan. Very close to the next, if really different; the head and mouth larger in the single specimen known.

(Milner, Rept. U. S. Fish Com. 1872–'73, 88: *Prosopium couesi* Milner, in Jordan, Man. Vert. ed. 2, 362.)

487. C. williamsoni Girard.—*Rocky Mountain White-fish.*

Body oblong, rather deeper than in *C. quadrilateralis*, but little compressed. Head shortish, conic, the profile more abruptly decurved than in the others. Snout compressed and somewhat pointed at tip, which is entirely below the level of the eye. Maxillary short and very

* Milner, in Jordan Man. Vert. ed. 2, 331: type *C. quadrilateralis* Rich. (*προσωπεῖον*, a mask; from the broad preorbital.)

broad, reaching just about to the anterior margin of eye; therefore, apparently longer than in the next, owing to the shortness of the snout. Maxillary contained 4 times in the length of the head; mandible 3 times. Mouth inferior. Eye $4\frac{2}{3}$ in head. Adipose fin very large, extending behind anal. Depth $4\frac{1}{4}$ in length; head $4\frac{2}{3}$. D. 11–14; A. 11; scales 8–74 to 88–7. Gill-rakers short and thick, shorter than pupil; about 16 below the angle. Clear streams and lakes from the Rocky Mountains to the Pacific; abundant in the Sierra Nevada. An excellent food-fish; variable.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 133; Günther, vi, 187.)

488. C. quadrilateralis Richardson.—*Pilot-fish; Menomonee White-fish; Shad Waiter; Round-fish.*

Body elongate, not elevated nor much compressed, the back rather broad, the form more terete than in any of the other species. Mouth very small and narrow, inferior, the broad maxillary not reaching to opposite the eye, $5\frac{1}{2}$ in head. Head long, the snout compressed and bluntly pointed, its tip not below level of eye; profile not strongly decurved. Preorbital wider than pupil. Mandible originating under middle of eye, $3\frac{1}{3}$ in head. Adipose fin small. Gill-rakers short and stoutish, but rather longer than in *C. williamsoni*. Head 5 in length; depth $4\frac{3}{4}$. D. 11; A. 10; scales 9–80 to 90–8. Color dark bluish above, silvery below. Lakes of New Hampshire, Upper Great Lakes, northwestward to Alaska; abundant in cold, deep waters.

(Richardson, Franklin's Journ. 1823, 714; Günther, vi, 176: *Coregonus novæ-angliæ* Prescott, Amer. Journ. Sci. Arts xi, 342, 1851: *Coregonus novæ-angliæ* Günther, vi, 186.)

489. C. kennicotti Milner, MSS. *sp. nov.*

Body oblong, elliptical, the back not greatly elevated. Head very short and deep, the snout bluntly decurved and not projecting, the depth of the head at the nape greater than the distance from the end of the snout to the opercular margin. Mouth not inferior, the jaws almost equal; maxillary extremely short and broad, not quite reaching to the eye, its length $5\frac{1}{6}$ in head, its supplemental bone broad-ovate, broader than in *clupeiformis*. Gill-rakers as in *C. quadrilateralis*. Preorbital rather broad. Color pale, as in *clupeiformis*. Head $5\frac{1}{4}$ in length. D. 11; A. 13; scales 10–90–10. Types Nos. 8971 and 9600 of the United States National Museum from Fort Good Hope, British America, and Yucon River, Alaska, respectively. A strongly marked species, well distinguished among the American forms by the very obtuse head, but perhaps identical with some Siberian species.

†† Gill-rakers numerous, long and slender; preorbital long and narrow; maxillaries comparatively long; the supplemental bone ovate, rather broad. (*Coregonus.*)

‡ Tongue toothless, or nearly so; back elevated.

490. C. clupeiformis (Mitch.) Milner.—*Common White-fish.*

Body oblong, compressed, always more or less elevated, and becoming notably so in the adult. Head comparatively small and short, the snout bluntish, obliquely truncated; tip of snout on level of lower edge of pupil; width of preorbital less than half that of pupil. Maxillary reaching past front of orbit, about 4 in head. Eye large, 4–5 in head. Gill-rakers moderate, $\frac{2}{3}$ diameter of eye, about 20 below the angle. Color olivaceous above; sides white, but not silvery; lower fins sometimes dusky. Head 5; depth 3–4. D. 11; A. 11; scales 8–74–9. L. 20 inches. Great Lakes and northward; the best known and most highly valued of the American white-fishes. This species, like others of wide distribution, is subject to considerable variations, dependent on food, waters, etc. Feeds on minute organisms.

(*Salmo clupeiformis* Mitchill, Amer. Month. Mag. ii, 321, 1818: *Coregonus albus* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 231, 1818: *Coregonus albus* Günther, vi, 184, and of authors generally: *Coregonus richardsoni* Günther, vi, 185: *Coregonus sapidissimus* Günther, vi, 186: *Coregonus latior* Gunther, vi, 186: *Coregonus otsego*, the "Otsego Lake Bass", DeWitt Clinton Med. & Phil. Register, iii, 188.)

‡‡ Tongue with about three series of small teeth; body elongate, compressed.

491. C. labradoricus Rich.—*"Whiting"; Musquaw River White fish.*

Body rather elongate, compressed, the back not elevated. Head rather long and slender, compressed. Mouth rather small, the jaws equal, the maxillary reaching to the front of the pupil. Maxillary bone broad, rather short, its supplementary piece ovate. Mandible reaching middle of eye. Eye large, $4\frac{3}{8}$ in head. Supraorbital bone narrow. Gill-rakers rather long. Bluish black above, silvery below; scales with dark punctulations; fins all dusky. Dorsal fin high in front, the last rays short. Head $4\frac{2}{3}$; depth $4\frac{1}{3}$. D. 11; A. 11; scales 9–80–8. L. 12 inches. Great Lake region to the lakes of the Adirondacks and White Mountains, and northeastward; generally abundant in cold, clear lakes.

(Richardson, Fauna Bor.-Amer. iii, 206, 1836; Günther, vi, 176: *Coregonus neohantoniensis* Prescott, Amer. Journ. Sci. Arts, xi, 342, 1851.)

‡‡‡ Tongue nearly toothless; back not elevated.

492. C. hoyi (Gill) Jordan.—*Lake Moon-eye; Cisco of Lake Michigan.*

Body rather elongate, compressed, the back somewhat elevated. Head rather long, in form intermediate between *Coregonus* and *Argyro-*

somus. Mouth rather large, terminal, the lower jaw evidently shorter than upper, even when the mouth is open; tip of muzzle rather bluntly truncate; maxillary reaching to opposite middle of pupil, about 3 in head; mandible extending to posterior margin of pupil. Supraorbital and preorbital narrow. Eye very large, $3\frac{1}{2}$ in head. Tongue with traces of teeth. Gill-rakers slender, about 25 below the angle, rather long, nearly as long as eye. Pseudobranchiæ very large. Fins low; free margin of dorsal very oblique. Color bluish above, sides and below rich silvery, brighter than in any other of our *Coregoni*, much as in *Hyodon* and *Albula*. Lateral line almost straight. Head $4\frac{1}{8}$; depth $4\frac{3}{4}$. D. 10; A. 10; scales 7–75–7. L. 12 inches. Deep waters of Lake Michigan, Lake Ontario, and neighboring lakes; the smallest and handsomest of our *Coregoni*. It is intermediate in its relations between the typical *Coregoni* and *Argyrosomus*.

(*Argyrosomus hoyi* (Gill, MSS.) Milner, Rept. U. S. Fish Com. 1872–'73, 86, 1874; Jordan, Man. Vert. ed. 2, 275.)

**Lower jaw projecting; premaxillaries narrow, placed more or less horizontally.

§ Body elongate, subfusiform; scales small, uniform, convex behind. (*Argyrosomus* Agassiz.*)

493. C. merki Gthr.

Steel-bluish above, with many dark points; belly white; dorsal and caudal mostly blackish; pectorals and ventrals tipped with black; eye blackish, the iris silvery. Body rather elongate, compressed. Form of mouth as in *C. artedi*, the lower jaw considerably projecting; maxillary broad, with rather broad supplemental bone, three times as long as wide, extending to middle of the very large eye, its length 3 in head; preorbital extremely narrow. Length of mandible somewhat more than least depth of tail. Teeth none, or reduced to minute asperities on the tongue. Gill-rakers numerous, very long and slender. Dorsal very high, much higher than long, its last rays rapidly shortened, the first rays twice the length of base of fin; insertion of dorsal midway between snout and middle of adipose fin. Caudal large, well forked; anal small; ventral inserted under middle of dorsal, very long, $\frac{5}{6}$ length of head; pectoral the same length. Scales as in *C. artedi*. Head 5; depth $5\frac{2}{3}$. Eye 3 in head. D. 11; A. 14; V. 11; scales 7–80–8. Behring's Sea to the north shore of Siberia, ascending rivers; lately obtained by Dr. Bean in Alaska.

(*Salmo clupeoides* Pallas, Zoogr. Ross. Asiat. iii, 410; not *Coregonus clupeoides* Lacépède; Günther, vi, 195.)

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*Agassiz, Lake Superior, 150, 339: type *Coregonus clupeiformis* DeKay, not of Mitchill, = *Coregonus artedi* Le Sueur. (αργυρος, silver; σῶμα, body.)

494. C. artedi Le Sueur.—*Lake Herring; Cisco; Michigan Herring.*

Body elongate, compressed, not elevated. Head compressed, rather pointed. Mouth rather large, the maxillary reaching about to the middle of the pupil, about 3½ in head; the mandible 2¼ in head. Preorbital bone long and slender; suborbital broad; supraorbital nearly as long as eye, about 4 times as long as broad. Eye 4–5 in head. Gill-rakers very long and slender, as in *Clupea*, as long as eye, 25–30 below the angle. Bluish black or greenish above; sides silvery; scales with dark specks. Fins mostly pale, the lower dusky-tinged. Head 4½; depth 4½. D. 10; A. 12; scales 8–75 to 90–7. L. 12 inches. Great Lakes and northward to Alaska and Labrador; very abundant, usually frequenting shallow waters. In numerous small lakes in Indiana and Wisconsin (Geneva, Tippecanoe, Oconomowoc, etc.) is the modified var. *sisco* (*Argyrosomus sisco* Jordan, Amer. Nat. 1875, 136), which lives in the deep waters, coming into shallower waters to spawn in December.

(*Coregonus artedi* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 231, 1818: *Coregonus clupeiformis* Günther, vi, 193, and of nearly all authors, but not *Salmo clupeiformis* of Mitchill: *Salmo* (*Coregonus*) *harengus* Richardson, Fauna Bor.-Amer. iii, 210: *Salmo* (*Coregonus*) *lucidus* Richardson, Fauna Bor.-Amer. iii, 207: *Coregonus lucidus* Günther, vi, 198: *Coregonus harengus* Günther, vi, 199.)

495. C. nigripinnis (Gill) Jor.—*Blue-fin; Black-fin.*

Body stout, fusiform, compressed. Head stout. Mouth large, the lower jaw projecting. Eye rather large, longer than snout, about 4 in head. Teeth very minute, but appreciable on premaxillaries and tongue. Gill-rakers very numerous, long and slender. Color dark bluish above; sides silvery, with dark punctulations; fins all blue-black. Head 4½; depth 3¾. D. 10; A. 12; scales 9–88–7. L. 18 inches. Deep waters of Lake Michigan; locally abundant. Larger than most of the other *Coregoni*. Known at once by the black fins.

(*Argyrosomus nigripinnis* (Gill, MSS.) Milner, Rept. U. S. Fish Com. 1872–'73, 87, 1875; Jordan, Man. Vert. 275.)

§§ Body short, deep, compressed, shad-like; curve of the back similar to that of the belly; scales large, notably larger forwards, rather closely imbricated, the posterior margin little convex. (*Allosomus* Jordan.*)

496. C. tullibee Rich.—*Tullibee; "Mongrel White Fish".*

Body short, deep, compressed, shad-like, the dorsal and ventral curves similar. Caudal peduncle short and deep. Head conic, compressed, much as in *C. nigripinnis*. Mouth large, the maxillary as long

*Jordan, Man. Vert. ed. 2, 1878, 331: type *Coregonus tullibee* Rich. (ἄλλος, other, different; σῶμα, body.)

as the eye, extending past the front of the pupil, its supplemental bone narrowly ovate, with prolonged point; jaws equal when closed. Eye large, as long as snout, 4½ in head. Preorbital narrow; supraorbital elongate, rectangular. Scales anteriorly considerably enlarged, their diameter half larger than the diameter of those on the caudal peduncle. Color bluish above; sides white, punctate with fine dots; each scale with a silvery area, these forming a series of distinct longitudinal stripes. Head 4; depth 3. D. 11; A. 11; scales 8–74–7. L. 18 inches. Great Lakes and northward. A handsome and well-marked species.

(*Salmo* (*Coregonus*) *tullibee* Rich. Fauna Bor.-Amer. iii, 201, 1836; Günther, vi, 199: *Argyrosomus tullibee* Jordan, Man. Vert. 361.)

147.—THYMALLUS Cuvier.

Graylings.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type *Salmo thymallus* L.)

Body oblong, compressed, little elevated. Head rather short. Mouth moderate, terminal, the short maxillary extending past the middle of the large eye, but not to its posterior margin. Teeth slender and sparse on the maxillaries, premaxillaries, and lower jaw; vomer short, with a small patch of teeth; teeth on the palatines; tongue toothless, or nearly so. Gill-openings wide. Branchiostegals 7 or 8. Gill-rakers short and rather stiff. Suborbital and preorbital bones narrow. Scales small and loose, 75–100 in the course of the lateral line. Dorsal fin very long and high, mostly in advance of the ventrals, of about 20 rays; adipose fin small; caudal fin forked; anal fin small, of 10–15 rays. Coloration brilliant, the dorsal with red or blue spots. Pseudobranchiæ well developed. Air-bladder very large. Pyloric appendages about 15. Beautiful fishes of the fresh waters of northern regions. (*θύμαλλος*, the Greek name of the Grayling, the fish having the odor of thyme—*θύμος*.)

497. T. signifer Richardson.—*American Grayling.*

Body elongate, compressed, highest under the anterior portion of the dorsal. Head rather short, subconic, compressed, its upper outline continuous with anterior curve of the back. Mouth moderate, the maxillary extending to below the middle of the eye; jaws about equal. Tongue, in the young, with teeth which are usually absent in the adult. Eye quite large, about 3 in head, rather longer than snout, about equal to the interorbital space. Scales moderate, easily detached. Lateral

line nearly straight. A small bare space behind isthmus. Dorsal fin long and high, its length rather greater than the depth of body, its height varying, greatest in the males; adipose fin rather small; anal fin small. Gill-rakers slender, short, about 11 below the angle. Coloration brilliant, (in var. *tricolor*) purplish gray; young silvery; sides of head with bright bluish and bronze reflections; sides of body with small, black, irregular spots, most numerous posteriorly in young specimens; ventral fins ornate, dusky, with diagonal rose-colored lines; dorsal with a black line along its base, then a rose-colored one, then a blackish one, then rose-colored, blackish, and rose-colored, the last stripe continued as a row of spots; above these is a row of dusky-green spots, then a row of minute rose-colored spots, then a broad dusky area, the middle part of the fin tipped with rose; anal and adipose fins dusky; central rays of caudal pink, outer rays dusky. Head $4\frac{3}{4}$; depth $4\frac{2}{3}$. D. 20; A. 11; scales 8–90–9. L. 18 inches. Northern Michigan to Montana, northward to Alaska and the Arctic Ocean; abounding in clear, cold streams in suitable locations. Professor Milner (Rept. U. S. Fish Com. 1872–'73, 740, *et seq.*) recognizes three distinct species, which seem to us rather as varieties of one species. These are—

Var. **signifer** Rich.

From British America and Alaska. Has the scales smaller, (Lat. l. 98), the maxillary shorter, and the head rather less than one-fifth the length; the dorsal rays are perhaps more numerous, and the fin in the males much higher.

(*Coregonus signifer* Rich. Franklin's Journ. 1823, 711: *Salmo* (*Thymallus*) *signifer* Rich. Fauna Bor.-Amer. iii, 190; Günther, vi, 202; Milner, Rept. U. S. Fish Com. 1872–'73, 738.)

Var. **tricolor** Cope.—*Michigan Grayling.*

From various streams in the northern part of the southern peninsula of Michigan. Has a longer head than the preceding, forming a little more than one-fifth the length, and the scales larger, 90–92 in the lateral line.

(*Thymallus tricolor* Cope, Proc. Acad. Nat. Sci. Phila. 1865, 80: *Thymallus tricolor* Günther, vi, 201: *Thymallus tricolor* Milner, Rept. U. S. Fish. Com. 1872–'73, 739, and of late writers on angling generally.)

Var. **montanus** Milner.—*Montana Grayling.*

From the headwaters of the Missouri. Similar to *tricolor*, but has the body deeper, the depth being about $4\frac{1}{2}$ in the length.

(*Thymallus montanus* Milner, Rept. U. S. Fish Com. 1872–'73, 741, 1874.)

148.—STENODUS Richardson.

Inconnus.

(*Luciotrutta* Günther.)

(Richardson: type *Salmo mackenzii* Rich.)

Body rather elongate, little compressed. Head long, the cleft of the mouth wide. Maxillary long, broad, lanceolate, extending far backward, lower jaw projecting much beyond the upper. Dentition very feeble, the teeth extremely small; maxillary toothless; vomer, palatines, and tongue with narrow bands of minute villiform teeth. Gill-rakers rigid, awl-shaped, rough interiorly. Branchiostegals 10. Pyloric cœca in great number. Dorsal fin moderate, over ventrals; anal rather long; caudal forked. Scales moderate. Coloration silvery. Migratory trout of large size, inhabiting the streams of Arctic America and Asia. (στένος, narrow; ὀδούς, tooth.)

498. S. mackenzii Richardson.—*Inconnu.*

Body elongate, subterete. Head long and compressed, with flattened vertex. Eye moderate. Preopercle much curved. Dorsal fin nearer caudal than snout. Bluish above; sides silvery, as in the *Coregoni.* Head 3½. B. 10; D. 13; A. 15; scales 11–106–10. Mackenzie's River and its tributaries.

(*Salmo mackenzii* Richardson, Franklin's Journ. 1823, 707: *Luciotrutta mackenziei* Günther, vi, 164.)

149.—ONCORHYNCHUS Suckley.

Pacific Salmons.

(Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 312: type *Salmo scouleri* Rich.)

Body elongate, subfusiform or compressed. Mouth wide, the maxillary long, lanceolate, usually extending beyond the eye; jaws with moderate teeth, which become in the adult male enormously enlarged in front. Vomer long and narrow, flat, with a series of teeth both on the head and the shaft, the latter series comparatively short and weak; palatines with a series of teeth; tongue with a marginal series on each side; teeth on vomer and tongue often lost with age; no teeth on the hyoid bone. Branchiostegals more or less increased in number. Scales moderate or small. Dorsal fin moderate; anal fin comparatively elongate, of 14–20 rays. Pyloric appendages in increased number. Gill-rakers rather numerous. Ova large. Sexual peculiarities very strongly developed; the snout in the adult males in summer and fall greatly distorted; the premaxillaries prolonged, hooking over the lower jaw, which in turn is greatly elongate and somewhat hooked at tip; the

teeth on these bones also greatly enlarged. The body becomes deep and compressed; a fleshy hump is developed before the dorsal fin, and the scales of the back become imbedded in the flesh. The flesh, which is red and rich in spring, becomes dry and poor. Salmon, mostly of large size, ascending the rivers tributary to the North Pacific in North America and Asia, spawning in the fall. Only five species are certainly known. (ὄγκος, hook; ῥυγχος, snout.)

The species may be divided as follows:

* Gill-rakers comparatively short and few (20 to 25 in number).
  a. Scales very small, more than 200 in a longitudinal series.....*gorbuscha.*
  aa. Scales medium, about 145 (138–155) in a longitudinal series; pyloric cœca about 150.
    b. Anal rays 13 or 14; black spots small or obsolete.; B. 13–14.....*keta.*
    bb. Anal rays about 16; back and upper fins with black spots; B. 15–19..*chouicha.*
  aaa. Scales comparatively large, about 130 (125–135) in a longitudinal series; pyloric cœca 50–80.....*kisutch.*
** Gill-rakers comparatively long and numerous (30–40 in number); scales large; lat. l. about 130.....*nerka.*

* Gill-rakers comparatively short and few (20-25 in number).
  a. Scales very small, more than 200 in a longitudinal series.

493. O. gorbuscha (Walb.) Gill & Jordan.—*Humpback Salmon; Haddo; Holia; Gorbuscha; Dog Salmon* (Alaska).

Color bluish; sides silvery; back posteriorly, adipose fin, and tail with numerous black spots; fall males red, more or less blotched with brownish. Body rather slender, in the female plump and symmetrical, in the fall males very thin and compressed, with the fleshy dorsal hump much developed and the jaws much elongated, strongly hooked, and with extravagant canines in front. Ventral appendage half the length of the fin. B. 11–12. Gill-rakers 13 + 15. A. (developed rays) 15; D. 11; scales 215 (210–240), those of the lateral line larger, 170. Pyloric cœca very slender, about 180. Weight 3–6 pounds. Pacific coast and rivers of North America and Asia from Oregon northward; not rare; occasionally taken in the Sacramento. Known at once by the very small size of the scales.

(*Salmo gorbuscha* Walbaum, Artedi Pisc. 1792, 69: *Salmo proteus* Pallas, Zoogr. Ross. Asiat. iii, 376: *Salmo gibber* Bloch & Schneider, 409: *Oncorhynchus proteus* Günther, vi, 157: *Salmo proteus* Suckley, Monogr. Salmo, 97; Jordan, Proc. U. S. Nat. Mus. i, 71, 1878: *Salmo scouleri* Rich. Fauna Bor.-Amer. iii, 158. *Oncorhynchus scouleri* Günther, vi, 158.)

aa. Scales medium, about 145 (138–155) in a longitudinal series; pyloric cœca about 150.
  b. Anal rays 13 or 14; black spots small or obsolete.

500. O. keta (Walbaum) Gill & Jordan.—*Dog Salmon; Hay-ko; Le Kai Salmon.*

Dusky above; sides paler, little lustrous; back and sides with no

defined spots, but only fine specklings, which are often entirely obsolete; head dusky, scarcely any metallic lustre on head or tail; caudal dusky, plain, or very finely maculate, its edge usually distinctly blackish; fins all mostly blackish, especially in males; breeding males generally blackish above, with sides brick-red, often barred or mottled. General form of the Quinnat, but the head proportionately longer, more depressed and pike-like; the preopercle more broadly convex behind, and the maxillary extending considerably beyond eye. Gill-rakers few, coarse, and stout, as in the Quinnat. Accessory pectoral scale short, not half the length of fin. Head 4; depth 4. D. 9; A. 13–14; scales about 28–150–30; B. 13 or 14, rather broad; gill-rakers 9 + 15; pyloric cœca 140–185; weight about 12 pounds. San Francisco to Kamtschatka, ascending all streams in the fall, and spawning at no great distance from the sea; abundant in Behring's Straits. At the time of its run the males of this species are much distorted and the flesh has little value.

(*Salmo keta* vel *Kayko* Walbaum, Artedi Pisc., 1792, 72: *Salmo keta* vel *Kayko* Bloch & Schneider, 1801, 407: *Salmo lagocephalus* Pallas, Zoogr. Ross. Asiat. iii, 372, 1811–'31: *Salmo canis* Suckley, Ann. Lyc. Nat. Hist. N. Y. 1858, 9, and Monogr. Salmo, 101: *Oncorhynchus lagocephalus* Günther, vi, 161.)

bb. Anal rays about 16; back and upper fins with black spots.

501. O. chouicha (Walb.) J. & G.—*Quinnat Salmon; King Salmon; Columbia Salmon; Sacramento Salmon; Chinnook Salmon; Tyee Salmon; Fall Salmon (male); Spring Salmon; Winter Salmon; Saw-kwey; Chouicha.*

Color dusky above, often tinged with olivaceous or bluish; sides and below silvery; head dark slaty, usually darker than the body and little spotted; back, dorsal fin, and tail usually profusely covered with round black spots (these are sometimes few, but very rarely altogether wanting); sides of head and caudal fin with a peculiar metallic tin-colored lustre; male, about the spawning season (October) blackish, more or less tinged or blotched with dull red. Head conic, rather pointed in the females and spring males. Maxillary rather slender, the small eye behind its middle. Teeth small, longer on sides of lower jaw than in front; vomerine teeth very few and weak, disappearing in the males. In the males in late summer and fall, the jaws become elongate and distorted, and the anterior teeth much enlarged, as in the related species. The body then becomes deeper, more compressed, and arched at the shoulders, and the color nearly black. Preopercle and opercle strongly convex. Body comparatively robust, its depth greatest near its middle. Ventrals inserted behind middle of dorsal, ventral appendage half the length of the fin; caudal, as usual in this genus, strongly forked, on a rather slender caudal peduncle. Flesh red and

rich in spring, becoming paler in the fall as the spawning season approaches. Head 4; depth 4. B. 15–16 to 18–19, the number on the two sides always unlike. D. 11; A. 16. Gill-rakers usually 9 + 14 (*i. e.*, 9 above the angle and 14 below). Pyloric cœca 140–185. Scales usually 27–146–29, the number in a longitudinal series varying from 140–155, and in California specimens occasionally as low as 135. Vertebræ 66. L. 36 inches. Usual weight in the Columbia River 22 pounds, elsewhere 16–18 pounds, but individuals of 70–100 pounds have been taken. Ventura River to Alaska and Northern China, ascending all large streams; especially abundant in the Columbia and Sacramento Rivers, where it is the principal salmon. Upwards of 30,000,000 pounds are now taken yearly in the Columbia River. It ascends the large streams in spring and summer, moving up, without feeding, until the spawning season, by which time many of those which started first may have travelled more than a thousand miles. After spawning, most or all of those which have reached the upper waters perish from exhaustion. It is by far the most valuable of our salmon. It has lately been introduced into many eastern streams.

(*Salmo tshawytscha** Walbaum, Artedi Pisc. 1792, 71: *Salmo orientalis* Pallas, Zoogr. Ross. Asiat. iii, 367, 1811–'31: *Salmo quinnat* Rich. Fauna Bor.-Amer. iii, 219, and of writers generally: *Oncorhynchus quinnat* Günther, vi, 158: *Oncorhynchus orientalis* Günther, vi, 159: *Oncorhynchus quinnat* Jordan, Proc. U. S. Nat. Mus. i, 69: *Fario argyreus* Girard, Acad. Nat. Sci. Phila. 1856, 218: *Salmo quinnat, confluentus*, and *argyreus* Suckley, Monogr. Salmo, 105, 109, 110: *Salmo tschawytscha* Bloch & Schneider, 1801, 407.)

aaa. Scales comparatively large, about 130 (125–135) in a longitudinal series; pyloric cœca 50–80.

502. O. kisutch (Walb.) Jor. & Gilb.—*Silver Salmon; Kisutch; Skowitz; Hoopid Salmon; Coho Salmon; Bielaya Ryba.*

Bluish green; sides silvery, with dark punctulations; no spots except a few rather obscure on top of head, back, dorsal fin, adipose fin, and the rudimentary upper rays of the caudal; rest of the caudal fin unspotted; pectorals dusky tinged; anal with dusky edging; sides of head without the dark coloration seen in the Quinnat; males mostly red in fall, and with the usual changes of form. Body rather elongate, compressed. Head short, exactly conical, terminating in a bluntly pointed snout, which is longer and broader than the lower jaw. Head shorter than in a young Quinnat of the same size. Interorbital space broad and strongly convex. Opercle and preopercle strongly convex behind; the preopercle very broad, with the lower limb little developed. Cheeks

* A barbarous spelling of the word "*chouicha*" which we have thought proper to simplify.

broad. Eye quite small, much smaller than in young Quinnat of the same size. Suborbital very narrow, with a row of mucous pores along its surface. Maxillary slender and narrow, but extending somewhat beyond the eye. Teeth very few and small, only two or three on the vomer; those on tongue very feeble. Gill-rakers 10 + 13, rather long and slender, nearly as long as eye, toothed. Fins small. Pectorals and ventrals short, the ventral appendage three-fifths the length of the fin; caudal strongly forked, on a slender peduncle. Head 4; depth 4. B. 13–14. Pyloric cœca very few and large, 63 (45–80); scales 25–127–29. D. 10; A. 13–14 (developed rays). L. 15 inches. Weight 3–8 pounds. A small salmon, ascending streams in the fall to no great distance. Abundant from San Francisco northward.

(*Salmo kisutch* Walbaum, Artedi Pisc. 1792, 70: *Salmo kysutsch* Bloch & Schneider, 1801, 407: *Salmo sanguinolentus* Pallas, Zoogr. Ross. Asiat. iii, 379: *Oncorhynchus sanguinolentus* Günther, vi, 160: *Oncorhynchus lycaodon* Günther, vi, 155, in part: *Salmo scouleri* Suckley, Monogr. Salmo, 94: *Salmo tsuppitch* Richardson, Fauna Bor.-Amer. iii, 224, 1836: *Salmo tsuppitch* Günther, vi, 118 (not of Jordan, Proc. U. S. Nat. Mus. i, 72, 1878, = *Salmo purpuratus*); *Oncorhynchus tsuppitch*, Jordan, Forest and Stream, September 16, 1880, 130.)

** Gill-rakers comparatively long and numerous (30 to 40 in number); scales large, in about 130 series.

503. O. nerka (Walbaum) Gill & Jordan.—*Blue-back Salmon; Red-fish; Frazer's River Salmon; Sugk-eye Salmon; Krasnaya Ryba.*

Color clear bright blue above; sides silvery, this hue overlying the blue of the back; lower fins pale, upper dusky; no spots anywhere in adults in spring; the young with obscure black spots above; males deep crimson red in the fall; the fins blackish, the caudal then often speckled with black; young breeding males ("*Kennerlyi*") often sharply spotted. Body elliptical, rather slender. Head short, sharply conic, pointed, the lower jaw included. Maxillary rather thin and small, extending beyond eye. Teeth all quite small, most of them freely movable; vomer with about 6 weak teeth, which grow larger in fall males, instead of disappearing. Preopercle very wide and convex; opercle very short, not strongly convex. Preopercle more free behind than in *O. chouicha*. Ventral scale about half the length of the fin; caudal fin narrow, widely forked; anal fin long and low; dorsal low. Flesh deep red. Males becoming extravagantly hook-jawed in the fall, the snout being then prolonged and much raised above the level of rest of head, the lower jaw produced to meet it. Mandible $1\frac{1}{3}$ in head, in fall males, $1\frac{3}{4}$ in females; snout $2\frac{1}{4}$ in head, in fall males, $3\frac{1}{2}$ in females. Head 4; depth 4. Gill-rakers as long as eye, more numerous than in any other of our salmon, usually 16–23. B. 14 + 13. D. 11; A. 14; scales 20–133–20;

pyloric cœca 75–95. Vertebræ 64. L. 24 inches. Weight 4 to 8 pounds. Columbia River to Kamtschatka; generally abundant, especially northward; ascending streams in spring to great distances, and often frequenting mountain lakes in fall, spawning in their small tributaries; one of the most graceful of the *Salmonidæ*, scarcely inferior to the Quinnat when fresh, but the flesh more watery and less valuable when canned.

(*Salmo nerka* Walbaum, Artedi, Pisc. 1792, 71: *Salmo nerka* Bloch & Schneider, 1801, 417: *Salmo lycaodon* Pallas, Zoogr. Ross. Asiat. iii, 370: *Salmo japonensis* Pallas, l. c.: ? *Salmo dermatinus* and *consuetus* Richardson, Voyage Herald, Zoöl. 167, 168 (probably *O. keta*): *Salmo paucidens* Richardson, Fauna Bor.-Amer. iii, 222: *Oncorhynchus lycaodon* pt. and *O. paucidens* Günther, vii, 155, 158: *Salmo cooperi*, *paucidens*, *warreni*, and *richardi*, Suckley, Monogr. Salmo, 92, *et seq.;* Jordan, Man. Vert. 357; Jordan, Proc. U. S. Nat. Mus. i, 71, 1878: *Salmo kennerlyi* Suckley, Ann. Lyc. Nat. Hist. N. Y. vii, 307, 1861, and Monogr. Salmo, 145 (young male or grilse, in breeding season): *Salmo kennerlyi* Günther, vi, 120: *Hypsifario kennerlyi* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 330: *Oncorhynchus kennerlyi* Jordan, Man. Vert. 357, and in Proc. U. S. Nat. Mus. i, 72, 1878: ? *Salmo tapdisma*, *arabatsch*, and *melampterus* Cuv. & Val. xxi, 314–6.)

150.—SALMO Linnæus.

Salmons.

(Artedi; Linnæus, Syst. Nat.: type *Salmo salar* L.)

Body elongate, somewhat compressed. Mouth large; jaws, palatines, and tongue toothed, as in related genera; vomer flat, its shaft not depressed, a few teeth on the chevron of the vomer, behind which is a somewhat irregular single or double series of teeth, which are sometimes deciduous with age. Scales large or small, 110–200 in a longitudinal series. Dorsal and anal fins short, of about 11 rays each; caudal fin truncate, emarginate, or forked, its peduncle comparatively stout. Sexual peculiarities variously developed; the males in typical species with the jaws prolonged and the front teeth enlarged, the lower jaw being hooked upwards at the end and the upper jaw emarginate or perforate. In some species these peculiarities are little marked. Species of moderate or large size, black-spotted, abounding in the rivers and lakes of Northern America, Asia, and Europe; one or two Atlantic species marine and anadromous. The non-migratory species (subgenus *Fario*) are in both continents extremely numerous, closely related, and difficult to distinguish. The excessive variations in color and form have given rise to a host of nominal species. European writers have described numerous hybrids among the various species of *Salmo*, real and nominal, found in their waters; as also among the various European *Cyprinidæ*. We have thus far failed to find the slightest evidence of any hybridism either among our American *Salmonidæ* or *Cyprinidæ*, in a state of nature. Puzzling aberrant or intermediate specimens

certainly occur, but such are not necessarily "hybrids." (*Salmo*, the Latin name of *S. salar*, originally from *salio*, to leap.)

The following observations on the species of trout are taken, with some slight abridgment and alteration, from Dr. Günther's account of this family (Cat. Fish. Brit. Mus. vi):

There is no other group of fishes which offers so many difficulties to the ichthyologist, with regard to the distinction of the species, as well as to certain points in their life history, as this genus. * * * The almost infinite variations of these fishes are dependent on age, sex, and sexual development, food, and the properties of the water. * * * The coloration is, first of all, subject to variation, and consequently this character but rarely assists in distinguishing a species, there being not one which would show in all stages the same kind of coloration. The young in all the species of this genus are barred, and this is so constantly the case that it may be used as a generic or even as a family character, not being peculiar to *Salmo* alone, but also to *Thymallus* and probably to *Coregonus*. The number of bars is not quite constant, but the migratory trout have two (or even three) more than the river-trout. When the *Salmones* have passed this "parr" state, the coloration becomes much diversified. The males, especially during and immediately after the spawning time, are more intensely colored and variegated than the females, specimens not mature retaining a brighter silvery color, and being more similar to the female fish. Food appears to have less influence on the coloration of the outer parts than on that of the flesh; thus, the more variegated specimens are frequently out of condition, whilst well-fed individuals, with pinkish flesh, are of more uniform though bright colors. * * * The water has a marked influence on the colors. Trout with intense ocellated spots are generally found in clear, rapid rivers and in alpine pools; in the large lakes, with pebbly bottom, the fish are bright silvery, and the ocellated spots are mixed with or replaced by X-shaped black spots; in dark holes, or lakes with peaty bottom, they often assume an almost uniform blackish coloration.

The brackish or salt water has the effect of giving them a bright-silvery coat, without or with few spots, none of them ocellated. With regard to size, the various species do not present an equal amount of variation. Size appears to depend on the abundance of the food and the extent of the water. Thus, the migratory species do not appear to vary considerably in size, because they find the same conditions in all the localities inhabited by them. A widely-spread species, however, like *Salmo fario* (or in America, *Salmo purpuratus*), when it inhabits a small mountain pool, with scanty food, never attains a weight of 8 ounces, while in a large lake or river, where it finds an abundance of food, it attains to a weight of 14 or 16 pounds. Such large river-trout are frequently named or described as Salmon-trout, Bull-trout, Steel-heads, etc.

The proportions of the various parts of the body to one another vary exceedingly, in the same species, with age, sex, and condition.

The fins vary to a certain degree. The variation in the number of rays in any one genus (except *Oncorhynchus*) is inconsiderable, and of no value for specific distinction. Although some species appear to be distinguished by a comparatively low dorsal and anal fin, yet the proportion of the height of these fins to their length is a rather uncertain character. In most of the species the fin-rays are longer during the stages of growth or development. The caudal fin especially undergoes changes with age. Young specimens of all species have this fin more or less deeply excised, so that the young of a species which has the caudal emarginate throughout life is distinguished by a deeper incision of the fin from the young of a species which has it truncate in the young state. The individuals of the same species do not all attain to maturity at the same size.

Finally, to complete our enumeration of these variable characters, we must mention that in old males, during and after the spawning season, the skin on the back becomes thickened and spongy, so that the scales are quite invisible or hidden in the skin.

After this cursory review of variable characters, we pass on to those which we have found to be constant in numbers of individuals, and in which it is difficult to perceive signs of modification due to external circumstances.

Such characters, according to the views of the zoölogists of the present age, are sufficient for the definition of species; at all events, in every description they ought to be noticed, and the confused and unsatisfactory state of our knowledge of Salmonoids is chiefly caused by authors having paid attention to the more conspicuous but unreliable characters, and but rarely noted one of those which are enumerated here.

1. The form of the præoperculum of the adult fish.
2. The width and strength of the maxillary of the adult fish. In young specimens and in females the maxillary is proportionately shorter than in the adult.
3. The size of the teeth, those of the premaxillaries excepted.
4. The arrangement and permanence of the vomerine teeth.
5. The development or absence of teeth on the hyoid bone. In old examples these are often lost, and their absence in a species usually provided with them is not uncommon.
6. The form of the caudal fin in specimens of a given size, age, or sexual development.
7. The size of the scales, as indicated by counting the number of transverse rows above the lateral line. The scales of the lateral line are always more or less enlarged or irregular and the number of scales should be ascertained higher up; this is one of the most constant and valuable of all the specific characters.
8. A great development of the pectoral fins, when constant in a number of specimens from the same locality.
9. The number of vertebræ.
10. The number of pyloric cœca.
11. The number of gill-rakers.

The species may be divided as follows:

* Marine salmon, anadromous, with the vomerine teeth little developed, those on the shaft of the bone few and deciduous; scales large (Lat. l. 120); caudal well forked, truncate in old individuals; no hyoid teeth; sexual differences strong; breeding males with the lower jaw hooked upwards, the upper jaw emarginate or perforate to receive its tip (SALMO).....*salar.*

** River salmon, not anadromous, with the vomerine teeth largely developed, those on the shaft of the bone numerous, persistent, in one zigzag row or two alternating rows; sexual differences not strongly marked, the male with the premaxillaries somewhat enlarged. (FARIO Valenciennes.)

a. Hyoid bone entirely toothless.

b. Scales large, 120–150 in a longitudinal series.

c. Caudal fin forked .....*irideus.*

cc. Caudal fin truncate .....*gairdneri.*

bb. Scales small, 165–205 in a longitudinal series.

d. Caudal fin truncate .....*spilurus.*

aa. Hyoid bone with a narrow band of small teeth (often lost); scales small (lat. l. 155 to 190) .....*purpuratus.*

* Marine salmon, anadromous, with the vomerine teeth little developed, those on the shaft of the bone few and deciduous; scales large (Lat. l. 120); caudal fin well forked, truncate in old individuals; no hyoid teeth; sexual differences strong; breeding males with the lower jaw hooked upwards, the upper jaw emarginate or perforate to receive its tip. (*Salmo.*)

504. S. salar Linnæus.—*Common Atlantic Salmon.*

Body moderately elongate, symmetrical, not greatly compressed. Head rather low. Mouth moderate, the maxillary reaching just past the eye, its length 2½–3 in head; in young specimens the maxillary is proportionately shorter. Preoperculum with a distinct lower limb, the angle rounded. Scales comparatively large, rather largest posteriorly, silvery and well imbricated in the young, becoming imbedded in adult males. Coloration in the adult brownish above, the sides more or less silvery, with numerous black spots on sides of head, on body, and on fins, and red patches along the sides in the males; young specimens (parrs) with about 11 dusky cross-bars, besides black spots and red patches, the color, as well as the form of the head and body, varying much with age, food, and condition; the black spots in the adult often X-shaped or XX-shaped. Head 4; depth 4. B. 11; D. 11; A. 9; scales 23–120–21; vertebræ 60; pyloric cœca about 65. Weight 15–40 pounds. North Atlantic, ascending all suitable rivers in Northern Europe and the region north of Cape Cod; sometimes permanently land-locked in lakes, where its habits and coloration (but no tangible specific characters) change somewhat, when it becomes (in America) var. *sebago*. One of the best known and most valued of food-fishes.

(Linnæus, Syst. Nat.; Günther, vi, 11, and of nearly all authors: *Salmo gloveri* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 85: *Salmo sebago* Girard, Proc. Acad. Nat. Sci. Phila. 1853, 380; Suckley, Monogr. Salmo, 143: *Salmo sebago* and *gloveri* Günther, vi, 153.)

** River salmon, not anadromous, with the vomerine teeth largely developed, those on the shaft of the bone numerous, persistent, in one zigzag row or two alternating rows; sexual differences not strongly marked, the males with the premaxillaries somewhat enlarged; flesh often pale. (*Fario* Valenciennes*).

a. Hyoid bone entirely toothless (tongue with teeth as usual).

b. Scales large, in 120–150 series.

c. Caudal fin forked.

505. S. iridcus Gibbons.—*California Brook Trout; Rainbow Trout.*

Body comparatively short and deep, compressed, varying considerably, and much more elongate in the males than in the females. Head short, convex, obtusely ridged above. Mouth smaller than in any other species of the genus, the rather broad maxillary scarcely reaching beyond the eye except in old males. Eye larger than in our other species, 5 in head. Vomerine teeth in two irregular series. Dorsal fin

* Valenciennes, Hist. Nat. Poiss. xxi, 227: type *Fario argenteus* Val. (*Fario*, a Latin name of the "Salmon Trout"; included species with a single row of permanent teeth on the vomer; *Salar*, Val. l. c. 314, included those with two rows, a distinction of no importance.)

moderate; caudal fin distinctly though not strongly forked, more deeply incised than in any other of our species of *Fario*. Scales compraatively large. Coloration bluish above, the sides silvery; everywhere above profusely but irregularly spotted, the spots extending on the sides and on the vertical fins; spots on caudal small; belly nearly plain; sea-run specimens nearly plain silvery; males with red lateral band and blotches. Head 4; depth $3\frac{4}{5}$. D. 11; A. 10; scales 21–135–20, varying considerably, the highest number noted being on the type of "*Fario newberrii*", 33–146–33. L. 24 inches. Weight $\frac{1}{2}$ to 6 pounds. Streams west of the Sierra Nevada, from near the Mexican line (Rio San Luis Rey) to Oregon; very abundant, and subject to many variations in size, form, and color.

(Gibbons, Proc. Cal. Acad. Nat. Sci. 1855, 36; Günther, vi, 119; Suckley, Monogr. Salmo, 129; Jordan, Proc. U. S. Nat. Mus. i, 75: *Fario gairdneri* Girard, U. S. Pac. R. R. Surv. Fish, x, 313 (not *Salmo gairdneri* Rich.): *Fario newberrii* Girard, Proc. Acad. Nat. Sci. Phila. 1858, 224: *Fario clarkii*, Girard, Proc. Acad. Nat. Sci. Phila. 219 (not *S. clarkii* Rich.): *Salmo masoni* Suckley, Monogr. Salmo, 134.)

cc. Caudal fin truncate (in the adult).

506. S. gairdneri Rich.—*Steel-head; Hard-head; Salmon Trout.*

Body rather stout, not very deep mesially, but with the caudal peduncle thick. Head comparatively short and rather slender, in the females small, in the males the jaws more or less prolonged; maxillary rather narrow, the small eye nearly above its middle; lower jaw included; upper jaw in males emarginate at tip and at junction of premaxillary. Teeth rather small, those on the vomer in two long, alternating series, which are about as long as the palatine series. Preopercle rather wide, with the lower limb short; opercle moderate. Gill-rakers short and thick, 8 + 12 (essentially as in our other species of *Fario*). Ventral appendage not half the length of the fin. Tail wide, squarely truncate in the adult, somewhat emarginate in the young. Flesh rather pale. Bones much firmer than in the *Oncorhynchi*. Color blue above; sides silvery; head, back, upper fins, and tail more or less densely covered with black spots; belly usually unspotted; males with colors heightened, the back greenish; a broad flesh-colored lateral band, deep red on the opercles; fins not red; no red on the membrane of lower jaw; B. 12–11; D. 11; A. 12; scales 20–135–20; pyloric cœca 42; vertebræ 38 + 20. L. 30 inches. Sacramento River and northward. A large trout, abounding in the mouths of the rivers, reaching a weight of 20 pounds. It spawns later than the salmon, and is found in the rivers, spent, at the time of the spring salmon run. It is then nearly useless as food, but at other times similar in quality to other trout.

(? *Salmo mykiss* Walbaum, Artedi, Pisc. 1792, 59, apparently confused with *S. purpuratus*: ? *Salmo muikisi* Bloch & Schneider, 419: *Salmo purpuratus* Günther, vi, 116: *Salmo*

truncatus Suckley, Ann. Lyc. Nat. Hist. N. Y. 1858, 3: *Salmo gairdneri* Richardson, Fauna Bor.-Amer. iii, 221: *Salmo gairdneri* Suckley, Monogr. Salmo, 114: *Salmo truncatus* Günther, vi, 122: *Salmo gairdneri* Günther, vi, 118.)

bb. Scales small, 165–205 in a longitudinal series.

d. Caudal fin truncate or double-rounded, not at all forked in the adult.

507. S. spilurus Cope.—*Rio Grande Trout.*

Body elongate. Head heavy, but proportionately short, its upper surface considerably decurved; interorbital space transversely convex, obtusely carinated; the head more convex than in any other of our species. Mouth very large, the maxillary reaching far past the eye. Teeth on vomer in two distinct series. Dorsal fin low in front, high behind, the last ray more than two-thirds the height of the first; last ray of the anal rather long; caudal with its middle rays about as long as the others. Profusely spotted; back and sides with round black spots, the spots most developed posteriorly, few on the head, most numerous on the caudal and adipose fin; sides with pale blotches. Head $3\frac{1}{2}$; depth 4. D. 11; A. 10; scales 37–170–37. L. 30 inches. Upper Rio Grande and Basin of Utah, frequenting mountain streams.

(Cope, Hayden's Geol. Surv. Mont. 1871, 470, 1872; Jordan, Proc. U. S. Nat. Mus. i, 74.)

Var. **pleuriticus** (Cope) Jor.

A more abundant and much more widely distributed form, having the head and mouth equally large, but the top of the head less convex, the median carina being more marked, especially in the young. The scales are definitely smaller (39–200–40) and the coloration is rather darker. This form abounds in all suitable streams from the Rio Grande, through the Basin of Utah. Specimens intermediate between *spilurus* and *pleuriticus* occur.

(*Salmo pleuriticus* Cope, Hayden's Geol. Surv. Mont. 1871, 471, 1872; Jordan, Proc. U. S. Nat. Mus. i, 74, 1878.)

aa. Hyoid bone with a narrow band of small teeth (easily scraped off and very often naturally deciduous, especially in old examples).

508. S. purpuratus Pallas.—*Salmon Trout of the Columbia; Yellowstone Trout; Rocky Mountain Brook Trout; Lake Trout.*

Body moderately elongate, compressed. Head rather short. Mouth moderate, the maxillary not reaching far beyond the eye. Vomerine teeth as usual, set in an irregular zigzag series; teeth on the hyoid bone normally present, but often obsolete, especially in old examples. Dorsal fin rather low; caudal fin slightly forked, less so than in *irideus*, more than in *spilurus* (the caudal more forked in young individuals

than in the adult, as in all trout). Scales moderate, varying to rather small. Back and caudal peduncle profusely covered with rounded black spots of varying size; dorsal, caudal, and adipose fin covered with small spots about as large as the nostril; a few spots on the head; belly rarely spotted; inner edge of the mandibles below with a red blotch; sea-run specimens are nearly uniform silvery; males with a broad lateral band and patches of light red; extremely variable in color and form. Head 4; depth 4. D. 10; A. 10. Cœca 43. Scales variable in size, 33–150–30 to 39–170–30. The common trout of the Rocky Mountains and Cascade region, abounding in all the streams of Alaska, Oregon, and Washington, where it descends to salt water, and reaches a weight of 20 pounds (Columbia River, Charles J. Smith); also in the Yellowstone region, the Upper Missouri, the Upper Rio Grande, Colorado, and the lakes of the Great Basin of Utah, being very abundant in Utah Lake. Not common south of Mount Shasta in California. This species is apparently the parent stock, from which our other black-spotted trout have scarcely yet become differentiated. Considerable local variations occur, especially in size, coloration, and size of scales. The red blotches on the lower jaw between the dentary bones and the membrane joining them is very constant and characteristic.

(*Salmo purpuratus* Pallas, Zöol. Ross. Asiat., iii, 374, 1811–31: *Salmo clarki* Rich. Fauna Bor.-Amer. iii, 224, 1836: *Fario stellatus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 219: *Salmo brevicauda* Suckley, Ann. Lyc. Nat. Hist. N. Y. vii, 308, 1861: *Salmo stellatus*, *gibbsi*, and *brevicauda* Günther, vi, 117–120: *Salmo clarki* Jordan, Proc. U. S. Nat. Mus. i, 77: *Salmo tsuppitch* Jordan, Proc. U. S. Nat. Mus. i, 72; *Fario aurora* Girard, Proc. Acad. Nat. Sci. Phila. viii, 218, 1856: *Salar lewisi* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 219: *Salar virginalis* Girard, l. c. 220: *Salmo carinatus* Cope, Hayden's Geol. Surv. Mont. 1871, 471–472: *Salmo utah* Suckley, Monogr. Salmo, 136: *Salmo aurora*, *lewisi*, and *virginalis* Günther, vi, 119–123.)

Var. **bouvieri** Bendire.—*Waha Lake Trout.*

Similar to *S. purpuratus*, but with dark spots only on the dorsal, caudal, and adipose fin, and on the tail behind front of anal, where the spots are very profuse, smaller than pupil. Anterior regions dusky bluish, not silvery; red blotch on inner edges of dentary bones below very conspicuous. Head shorter and deeper than in *purpuratus*, the snout shorter and blunter, not longer than eye, which is 4 in head. Opercle and preopercle less convex than in *purpuratus*. Maxillary $2\frac{1}{5}$ in head. Caudal moderately forked. Head 4; depth $4\frac{2}{3}$. D. 10; A. 11; B. 12; Lat. l. 175. Size small. A singularly colored local variety, found in Waha Lake, Washington Territory, a mountain lake without outlet.

(*Salmo bouvieri* Bendire, MSS.)

Var. **stomias** (Cope) J. & G.

Body short and stout. Head large and wide, above broad and flat, without keel, with wide mandible and mouth, the end of the maxillary extending half the diameter of the eye beyond the orbit. Eye $4\frac{2}{3}$ in head. Maxillary bone of nearly uniform width. Caudal fin truncate. General coloration of *S. spilurus*, the black spots most numerous posteriorly. Head $4\frac{1}{4}$; depth $4\frac{1}{4}$. D. 12; A. 10; scales 42 above lateral line, which probably contains about 200 scales. L. 24 inches. Kansas River to Upper Missouri. (*Cope.*) Like *S. spilurus* in its large mouth and very small scales, but differing in the presence of hyoid teeth and in the broad, flat head. We have seen only the head of an old male of this form, but think it will prove to be a variety of *S. purpuratus.*

(*Salmo stomias* Cope, Hayden's Geol. Surv. Wyom. 1870, 433, 1872: *Salmo stomias* Jordan, Hayden's Geol. Surv. Terr. 1878, 795.)

Var. **henshawi** Gill & Jordan.—*Lake Tahoe Trout; Silver Trout; Black Trout.*

Body elongate, not greatly compressed. Head comparatively slender and long-acuminate, its upper surface very slightly carinated; muzzle somewhat pointed, but bluntish at the tip; head not convex above; maxillary rather short, about as in *purpuratus*, not reaching much beyond the eye. Vomerine teeth as usual; a small, rather narrow, but usually distinct patch on the hyoid bone. Dorsal fin small; caudal fin short, rather strongly forked. Scales medium. Coloration dark, the sides silvery; back about equally spotted before and behind; sides with rather distant spots; belly generally spotted; head spotted even to the snout; dorsal and caudal also spotted. Head $3\frac{3}{4}$; depth 4. D. 11; A. 12; scales 27–160–27 to 37–184–37; cœca 50–60. L. 18 inches or more, usually weighing 5 or 6 pounds, but occasionally 25–30. Lake Tahoe, Pyramid Lake, and streams of the Sierra Nevada. Evidently a variety of *Salmo purpuratus*, but with a longer and more conical head. A fine trout, now common in the San Francisco markets.

(*Salmo henshawi* Gill & Jordan, Man. Vert. ed. 2, 358: *Salmo henshawi* and *Salmo tsuppitch* Jordan & Henshaw, Rept. Chief Eng., 1878, App. NN, 196, 197, plate: *Salmo henshawi* Jordan, Proc. U. Nat. Mus. i, 75, 1878.)

151.—SALVELINUS Richardson.

Charrs.

(*Baione* DeKay; *Umbla* Rapp.)

(Nilsson; Richardson, Fauna Bor.-Amer. iii, 170, 1836: type *Salmo salvelinus* L.)

Body moderately elongate. Mouth large or small. Teeth of jaws, palatines, and tongue essentially as in *Salmo*, the hyoid patch present

or not. Vomer boat-shaped, the shaft much depressed, with or without raised crest, with teeth on the chevron and none directly on the shaft. Scales very small, in 200–250 rows. Fins moderate, the caudal forked in the young, truncate in some species, in the adult. Sexual peculiarities not strongly marked, the males with the premaxillaries enlarged and a fleshy projection at the tip of the lower jaw. Coloration dark, with round crimson or gray spots, and the lower fins sometimes with marginal bands of black, reddish, and pale. Species numerous in the clear streams and lakes of the northern parts of both continents, sometimes descending to the sea, where they lose their variegated colors and become nearly plain and silvery. The members of this genus are in general the smallest and handsomest of the trout. (*Salvelinus*, an old name of the charr; allied to the German *Sälbling*, a little salmon.)

* Vomer with a raised crest behind the chevron, free from the shaft; the crest armed with teeth; hyoid teeth strong; lake trout, gray-spotted (*Cristivomer** Gill & Jordan).

509. S. namaycush (Walb.) Goode.—*Mackinaw Trout; Great Lake Trout; Longe* (*Vermont*); *Togue* (*Maine*).

Body elongate, covered with thin skin, there being no special development of fatty tissue. Head very long, its upper surface flattened. Mouth very large, the maxillary extending much beyond the eye, the head and jaws proportionately lengthened and pointed. Teeth very strong. Caudal fin well forked. Adipose fin small. General coloration dark gray, sometimes pale, sometimes almost black; everywhere with rounded paler spots, which are often reddish tinged; head usually vermiculate above; dorsal and caudal reticulate with darker. Eye large, $4\frac{1}{2}$ in head. Maxillary nearly half the length of the head; interorbital space nearly $\frac{1}{4}$. Head $4\frac{1}{4}$; depth 4. B. 11–12; D. 11; A. 11; Lat. l. 185–205. L. 36 inches. Great Lake region and lakes of Northern New York, New Hampshire, and Maine, to Montana and northward; very abundant in the larger bodies of water; varying in form and color in the different lakes.

(*Salmo namaycush* Walb. Artedi, Pisc., 1792, 68: *Salmo namaycush* Günther, vi, 123, and of authors generally: *Salmo amethystinus* Mitchill, Journ. Acad. Nat. Sci. Phila. 1818 410: *Salmo confinis* DeKay, N. Y. Fauna, Fish. 1842, 238: *Salmo adarondacus* Norris: *Salmo toma* Hamlin: *Cristivomer namaycush* Jordan, Man. Vert., ed. 2d, 359: *Salmo siscowet* Günther vi, 123.)

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*Jordan, Man. Vert. ed. 2, 1878, 356: type *Salmo namaycush* Walbaum. (*Crista*, crest; *vomer*, vomer.)

Var. **siscowet** (Agassiz) J. & G.—*Siscowet Salmon.*

Body short and deep, covered with thick skin, there being an excessive tendency to the development of fatty tissue. Head very short and deep, its upper surface broad and short, covered by a skin so thick as to completely hide the bones; no distinct median carina. Mouth very large, its gape narrower than in *S. namaycush*. Teeth weaker than in *S. namaycush;* supplemental bone also shorter and broader. Maxillary a little more than half the length of the head. Caudal fin well forked. Scales rather small, about 175 in the lateral line. Coloration as in *S. namaycush*, but usually paler; fin-rays the same. Lake Superior; abundant, but not yet found elsewhere. Very close to the preceding, but differing in the shortness and breadth of the bones of the head and in the extreme fatness of the flesh. It is probably a local variety rather than a distinct species.

(*Salmo siscowet* Agassiz, Lake Superior, 1850, 333.)

** Vomer without raised crest, the chevron only being toothed; red-spotted. (*Salvelinus.*)

a Hyoid bone with a narrow median band of teeth (sometimes lost).

510. S. oquassa (Grd.) Gill & Jor.—*Oquassa Trout; Blue-back Trout.*

Body elongate, considerably compressed, less elevated than in the other species of this genus, the dorsal outline regularly but not strongly curved. Head quite small, much smaller than in any other of our trout, its upper surface flattish. Mouth quite small, the maxillary short and moderately broad, scarcely extending to the posterior margin of the eye. Eye large, 3½ in head. Jaws about equal. Scales small, those along the lateral line somewhat enlarged. Pectoral and ventral fins not elongate; caudal fin well forked, more so than in the other species. Preopercle as in *S. fontinalis*, but the lower limb more developed; opercles without concentric striæ. Coloration dark blue, the red spots small and round, much smaller than the pupil, usually confined to the sides of the body; sides with traces of dark bars; lower fins varie-gated, as in *S. fontinalis*. Head 5; depth 5. D. 10; A. 9. Lat. l. 230; gill-rakers about 6 + 11. L. 12 inches. Smallest and handsomest of our trout, as yet known only from the Rangeley Lakes, in Western Maine.

(*Salmo oquassa* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 262: *Salmo oquassa* Günther, vi, 154; Jordan, Proc. U. S. Nat. Mus. i, 81.)

511. S. naresi (Günther) Bean.

Greenish above, sides silvery or deep red, with very small red spots, much smaller than the pupil; lower fins deep red, with the anterior

margins yellowish white. Body long and slender; head rather small, the snout blunt; mouth not large, the maxillary reaching posterior margin of orbit in male only; teeth very small; teeth on the middle line of the hyoid bone; angle of preopercle much rounded; gill-covers without concentric striæ; pectoral not longer than the head without snout; ventrals not to vent; caudal deeply forked; scales minute. Head $4\frac{1}{4}$; depth 5–6. D. 11; A. 9; B. 11; cœca 28–42; vert. 63. L. 12 inches. (*Günther.*) Lakes of Arctic America, Discovery Bay, and Cumberland Gulf.

(*Salmo naresii* Günther, Proc. Zoöl. Soc. Lond. 1877, 476, plate; Bean, Bull. U. S. Nat. Mus. xv, 135.)

512. S. arcturus (Gthr.) Gill & Jor.

Dull greenish, silvery or reddish below; lower fins yellowish; no red spots (on specimens seen). Body rather elongate; head small, the snout very obtuse; mouth moderate, the maxillary in the male reaching about to posterior margin of orbit; teeth small; a band of hyoid teeth; preopercle with a distinct lower limb; pectoral little shorter than head, reaching more than half way to ventral. Caudal moderately forked; scales minute. Head $4\frac{1}{2}$; depth 5; D. 11; A. 10; B. 11; cœca 31–44 L. 12 inches. Victoria Lake and Floeberg Beach, Arctic America, the northernmost Salmonoid known. (*Günther.*)

(*Salmo arcturus* Günther, Proc. Zoöl. Soc. Lond. 1877, 294, plate.)

513. S. malma (Walb.) J. & G.—*Dolly Varden Trout; Bull Trout; Red-spotted Trout; Salmon Trout; Malma; Golet.*

Body stout, the back somewhat elevated, deeper and less compressed than in *S. fontinalis*. Head large, snout broad, flattened above. Mouth large, the maxillary reaching past the eye. Eye $4\frac{1}{2}$ in head. Fins short; the caudal fin slightly forked or almost truncate; adipose fin usually large; in large specimens its length is twice that of the eye. General color olivaceous; the sides with round red spots near the size of the eye, the back commonly with smaller pale ones, a feature of coloration which distinguishes this species at once from the others; lower fins colored as in *fontinalis*, dusky, with a pale stripe in front, followed by a dark one; sea-run specimens silvery, with the spots faint or obsolete; fins and back without dark reticulations. Gill-rakers without concentric striæ. Head $3\frac{2}{3}$; depth 4. D. 11; A. 9; scales 39–240–36; pyloric cœca large, 45–50; gill-rakers about 8+12 as in others. L. 15 inches. Streams west of the Cascade Range, from Northern California to Alaska

and Kamtschatka, generally abundant northward, descending to the sea, where it reaches a weight of about 12 pounds.

(*Salmo malma* Walbaum Artedi, Pisc. 1792, 66: *Salmo callarias* Pallas Zoogr. Rosso-Asiat. iii, 353, 1811–31: *Salmo callarias* Günther, vi, 143: *Salmo spectabilis* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 218: *Salmo parkei* Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 309: *Salmo campbelli* Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 313: *Salmo parkii, lordii,* and *campbellii* Günther, vi, 121, 148, 149: *Salvelinis spectabilis* Jordan, Proc. U. S. Nat. Mus. i, 79, 1878: *Salmo tudes* Cope, Proc. Amer. Phil. Soc. Phila. 1873: *Salmo bairdii* Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 309: *Salmo bairdii* Günther, vi, 121; *Salvelinus bairdi* Jordan, Proc. U. S. Nat. Mus. i, 82.)

aa. Hyoid teeth wanting.

514. S. fontinalis (Mitch.) Gill & Jor.—*Brook Trout; Speckled Trout.*

Body oblong or elongate, moderately compressed, not much elevated. Head large, but not very long, the snout bluntish, the interorbital space rather broad. Mouth large, the maxillary reaching more or less beyond the eye. Eye large, usually somewhat above the line of the axis of the body. Caudal fin slightly lunate in the adult, forked in the young; adipose fin small; pectoral and ventral fins not especially elongate. Red spots on the sides, rather smaller than the pupil; back mostly without spots, more or less barred or mottled with dark olive or black; dorsal and caudal fins mottled or barred with darker; lower fins dusky, with a pale, usually orange band anteriorly, followed by a darker one; belly in the males often more or less red; sea-run individuals (*S. canadensis* Smith, the Canadian "Salmon Trout") are often nearly plain bright silvery; many local varieties distinguished by shades of color also occur. Head $4\frac{1}{2}$; depth $4\frac{1}{2}$. D. 10; A. 9; scales 37–230–30; gill-rakers about 6 + 11. L. 18 inches or less. The best known of our trout, abounding in all clear, cold streams from Pennsylvania to Dakota and northward to the Arctic Circle, southward in the Alleghanies to the headwaters of the Savannah, Chattahoochee, Catawba, and French Broad.

(*Salmo fontinalis* Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 435: *Salmo fontinalis* Günther, vi, 152, and of nearly all authors: *Salmo canadensis** Hamilton Smith, in Griffith's Cuvier, x, 474, 1834 (Canadian "Salmon Trout"): *Salmo immaculatus** H. R. Storer, Bost. Journ. Nat. Hist. vi, 364, 1850 (Canadian "Salmon Trout"): *Salmo immaculatus* Günther, vi, 125: *Salmo hudsonicus* Suckley, Ann. Lyc. Nat. Hist. N. Y. 1861, 310: *Salmo hudsonicus* Günther, vi, 153; Jordan, Proc. U. S. Nat. Mus. i, 81: ? *Salmo hearnii* Rich. Franklin's Journ. 706.)

515. S. hoodi (Rich.) Gill & Jor.

Body rather elongate. Maxillary rather strong, straight, extending to or beyond hind margin of eye. Preopercle very short, with a very short lower limb. Pectoral not reaching half way to ventral; adipose

*The nominal species *canadensis* and *immaculatus* are based on sea-run specimens of larger size, the so-called "Salmon Trout".

fin very small; caudal deeply forked. Body and caudal fin covered with round pale spots of moderate size. B. 12; D. 10; A. 9; Lat. l. 185. Boothia. (*Günther.*)

(*Salmo hoodii* Richardson, Ross, Voy. Nat. Hist. App. lviii, and in Fauna Bor.-Amer. iii, 173: *Salmo hoodii* Günther, vi, 150.)

516. S. rossi (Rich.) J. & G.

Olive-brown above, the dorsal and caudal similarly colored; belly red; scattered red spots near the lateral line. Rather slender; snout very obtuse; lower jaw remarkably long, with a knob at tip (male). About 30 teeth on the tongue. Conspicuous pores on the face bones posteriorly. Scales very small, imbedded. Head 5. B. 12–13; D. 13; A. 11; P. 14; V. 10. Arctic Ocean, about Boothia Felix. (*Richardson.*) An imperfectly known species.

(*Salmo rossii* Richardson, Nat. Hist. App. Ross's Voy. lvi: *Salmo rossii* Suckley, Monogr. Salmo, 120.)

517. S. nitidus (Rich.) Gill & Jor.

Body somewhat elongate; head moderate; snout medium. Maxillary straight, strong, extending beyond the orbit in the male. Teeth moderate, 2 or 3 behind head of vomer. Preopercle with the lower limb very distinct. Fins well developed; pectoral reaching scarcely half way to ventral; caudal fin forked. Head 5. B. 11; D. 11; A. 10; Lat. l. 215. Boothia. (*Günther.*) Perhaps a form of *S. stagnalis.*

(*Salmo nitidus* Richardson, Fauna Bor.-Amer. iii, 171, 1836: *Salmo nitidus* Günther, vi, 150.)

518. S. stagnalis (Fabr.) Gill & Jor.

Body elongate; head of moderate size. Snout elongate, pointed, with the lower jaw projecting beyond the upper in adult examples. Teeth small. Maxillary elongate, narrow, extending beyond the eye. Preopercle very short, with a very short lower limb. Opercle and preopercle very conspicuously and densely striated, the striæ radiating from the base of each. Fins much developed, the dorsal much higher than long; pectoral very long, reaching more than half way to ventrals, which are also very long; adipose fin very small; caudal well forked. D. 11; A. 10; Lat. l. 210; B. 11; cœca, 41. Lakes of Greenland and Boothia Felix. (*Günther.*)

(*Salmo stagnalis* Fabricius, Fauna Grœnlandica, 1780, 175: *Salmo alipes* Richardson, Nat. Hist. App. Ross's Voy. lvii, and Fauna Bor.-Amer. iii, 169: *Salmo alipes* Günther, vi, 149.)

Family XLVII.—PERCOPSIDÆ.

(*The Trout Perches.*)

Body moderately elongate, somewhat compressed, the caudal peduncle long and slender. Head conical, pointed, naked. Mouth small, horizontal; maxillary short, narrow, without supplemental bone, not reaching to the large eye; margin of upper jaw formed by premaxillaries alone, which are short and not protractile. Teeth very small, villiform on premaxillaries and lower jaw only. Tongue short, adherent. Gill-membranes separate, free from the isthmus. Pseudobranchiæ present. Branchiostegals 6. Gill-rakers short, tubercle-like. Opercle with entire edges. Lower limb of the preopercle well developed, the angle nearly a right angle, its inner edge with a raised crest. Bones of the head cavernous, as in *Acerina* and *Ericymba*. Cranium with a raised crest, which does not extend to the occiput. Scales moderate, rather thin, adherent, their edges strongly ctenoid. Lateral line continuous. Dorsal short, median; ventrals anterior, just in front of the dorsal, 8-rayed; pectorals narrow, placed rather higher than usual; anal small; caudal forked; adipose fin present, small. Stomach siphonal, with about 10 well-developed pyloric cœca. Ova rather large, not falling into the abdominal cavity before exclusion. Air-bladder present. Small fishes of the fresh waters of the cooler parts of America; a single genus, with probably but one species. The group is one of special interest, as it combines with ordinary Salmonoid characters the structure of the head and mouth of a Percoid, resembling notably the European genus *Acerina*.

(*Percopsidæ* Günther, vi, 207.)

152.—PERCOPSIS Agassiz.

Trout Perch.

(Agassiz, Lake Superior, 1850, 284: type *Percopsis guttatus* Ag.)

Characters of the genus included above. (περκη, perch; ὀψις, appearance.)

519. P. guttatus Agassiz.

Pale olivaceous, a silvery stripe along the lateral line, becoming obsolete forwards; upper parts with obscure round dusky spots made of dark points. Head slender and conical. Mouth small, subinferior, maxillary not nearly reaching front of orbit. Caudal peduncle long and

slender. Peritoneum silvery. Head $3\frac{4}{5}$ in length; depth about $4\frac{1}{3}$. D. 11; A. 8; Lat. l. 50. L. 6 inches. Spawns in spring. Delaware River to Kansas and northward; abundant in the Great Lakes. One of our most remarkable fishes.

(Agassiz, Lake Superior, 1850, 286; Günther, vi, 207: ? *Percopsis hammondi** Gill, Proc. Acad. Nat. Sci. Phila. 1864, 151.)

Order N.—HAPLOMI.

(*The Haplomous Fishes.*)

No precoracoid arch. Parietal bones separated by the supraoccipital. A symplectic. Opercular bones present. Anterior vertebræ unaltered. Pharyngeal bones distinct, the superior directed forwards, three or four in number, the inferior not falciform. No interclavicles. Mouth with teeth. Air-bladder with a pneumatic duct. Ventral fins abdominal, rarely wanting; pectoral fins placed low; dorsal fin more or less posterior, usually without spines. Head and body usually with cycloid scales. No adipose fin. Species chiefly inhabiting fresh water. (ἁπλοός, simple; ὠμος, shoulder; in allusion to the want of the precoracoid arch.)

(*Physostomi* part (families *Esocidæ, Umbridæ, Cyprinodontidæ* and *Heteropygii*) Günther, vi, vii.)

ANALYSIS OF FAMILIES OF HAPLOMI.

a. Margin of upper jaw formed by premaxillaries alone; ovoviviparous.
  b. Vent jugular; premaxillaries scarcely protractile.....AMBLYOPSIDÆ, 48.
  bb. Vent abdominal; premaxillaries freely protractile .....CYPRINODONTIDÆ, 49.
aa. Margin of upper jaw formed laterally by the maxillaries; premaxillaries not protractile.
  c. Jaws not produced; teeth villiform, equal.....UMBRIDÆ, 50.
  cc. Jaws produced; teeth cardiform, unequal.....ESOCIDÆ, 51.

Family XLVIII.—AMBLYOPSIDÆ.

(*The Blind-fishes.*)

Body moderately elongate, compressed behind. Head long, depressed. Mouth rather large, the lower jaw projecting; premaxillaries long, scarcely protractile, forming the entire margin of the upper jaw. Jaws and palatines with bands of slender villiform teeth. Branchiostegals about 6. Gill-rakers very short. Pseudobranchiæ concealed. Gill-membranes more or less completely joined to the isthmus.

* Head larger, $3\frac{1}{2}$ in length, exclusive of caudal; dorsal higher, the longest ray $4\frac{3}{3}$ in length; anal higher, longest ray 6 in length; pectoral equals height of dorsal; ventral $5\frac{3}{4}$ in length, reaching vent, which is nearer snout than margin of caudal fin. Kansas. (*Gill.*)

Head naked, the surface sometimes crossed by papillary ridges. Body with small cycloid scales, irregularly placed. No lateral line. Vent jugular, close behind the gill-openings. Ventral fins small or wanting; pectorals moderate, inserted higher than in most soft-rayed fishes; dorsal without spine, nearly opposite the anal; caudal truncate or rounded. Cranium without median crest. Stomach cœcal, with one or two pyloric appendages. Air-bladder present. Ovary single. Some (and probably all) of the species are ovoviviparous. In two of the genera the eyes are very rudimentary and hidden under the skin, and the body is translucent and colorless. Fishes of small size, living in subterranean streams and ditches of the Central and Southern United States. Three genera and four species are "all of the family yet known, but that others will be discovered, and the range of the present known species extended, is very probable. The ditches and small streams of the lowlands of our southern coast will undoubtedly be found to be the home of numerous individuals, and perhaps of new species and genera, while the subterranean streams of the central portion of our country most likely contain other species." (*Putnam.*)

(*Heteropygii* Günther, vii, 1, 2.)

a. Eyes rudimentary, concealed; body colorless.
b. Ventral fins present.....AMBLYOPSIS, 153.
bb. Ventral fins obsolete.....TYPHLICHTHYS, 154.
aa. Eyes developed; body colored; ventrals obsolete.....CHOLOGASTER, 155.

153.—AMBLYOPSIS DeKay.

(DeKay, New York Fauna, Fish. 1842, 187: type *Amblyopsis spelæus* DeKay.)

Eyes rudimentary, concealed under the skin. Surface of head crossed by vertical tactile ridges. Gill-membranes fully joined to isthmus. Ventral fins present, quite small, close to anal. Colorless fishes of small size, inhabiting the cave-streams in the limestone regions of the Western States. (*αμβλὺς*, obtuse; *ὀψίς*, vision.)

520. A. spelæus DeKay.

Colorless. Mouth comparatively large, the length of its cleft about equal to base of dorsal. Pectorals reaching front of dorsal; caudal long, rather pointed. One pyloric cœcum. Head 3 in length; depth 4½. D. 9; A. 8; V. 4; P. 11. L. 5 inches. Subterranean streams of Kentucky and Indiana.

(DeKay, New York Fauna, Fish. 187; Günther, vii, 2; Putnam, Amer. Nat. 1872, 30, fig.)

154.—TYPHLICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 62: type *Typhlichthys subterraneus* Grd.)

This genus differs from *Amblyopsis* only in the absence of the ventral

fins. The species are of smaller size, and are found in the same waters. (*τυφλὸς*, blind; *ἰχθὺς*, fish.)

521. T. subterraneus Grd.

Colorless. Head rather blunter and broader forwards than in *A. spelæus*. Mouth smaller, its cleft shorter than base of dorsal. Pectorals scarcely reaching dorsal. One pyloric cœcum. D. 7 or 8; A. 7 or 8. L. 2 inches. Subterranean streams of Kentucky, Tennessee, and Alabama.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 62; Putnam, Amer. Nat. 1872, 30, fig.)

155.—CHOLOGASTER Agassiz.

(Agassiz, Amer. Journ. Sci. Arts, xvi, 135, 1853: type *Chologaster cornutus* Ag.)

This genus has the general characters of *Amblyopsis*, but differs in the absence of ventral fins and in the fully developed condition of the eyes, which are small and lateral. The species are not pellucid, but colored like ordinary fishes. No papillary ridges. Pyloric cœca 2. Ditches and cave-streams. (*χωλος*, maimed; *γαστὴρ*, belly; in allusion to the abortive ventrals.)

522. C. cornutus Ag.

Yellowish brown, dark above; sides with three dark longitudinal stripes, becoming dots on the tail; middle rays of caudal fin dark; fins otherwise uncolored. Mouth moderate, oblique, the maxillary not extending to the eye. Pectorals reaching nearly to front of dorsal, perfect, small. Snout with two horn-like projections. Head $3\frac{1}{8}$; depth $4\frac{1}{2}$. D. 8 or 9; A. 8 or 9. L. $2\frac{1}{2}$ inches. Ditches in a rice-field, Waccamaw, S. C. (*Putnam.*)

(Agassiz, Amer. Journ. Sci. Arts, 1853, 135; Günther, vii, 2; Putnam, Amer. Nat. 1872, 30.)

523. C. agassizi Putnam.

Uniform light brown; fins somewhat speckled. Head 4 in body, its length scarcely greater than the greatest depth. Pectorals reaching little more than half way to front of dorsal. D. 9; A. 9. L. $1\frac{1}{4}$ inches. (*Putnam.*) Subterranean streams in Tennessee and Kentucky.

(Putnam, Amer. Nat. 1872, 30, fig.)

A specimen of *Chologaster* obtained by Prof. S. A. Forbes in a cave-stream of Southern Illinois does not agree well with either of the above species. The following description has been furnished us by Professor Forbes:

The head is $7\frac{1}{2}^{mm}$ long, and the body, without head or tail, 19^{mm}. Head in length, therefore, $3\frac{1}{2}$ times. The eye is above and well behind the maxillary, and goes about

6 in head. The pectoral reaches half way to the dorsal. The color is precisely as described for *cornutus*, except that the middle stripe is decidedly paler than the ground color of the body, but darker on the head, the change being abrupt at the opercular margin. The caudal fin is dark brown, with several vertical rows of white specks or blotches running across the rays. The anterior part of the dorsal is similar in color, but paler. Total length a trifle over an inch. A scale from the region mentioned by Putnam is similar to that of *agassizi*, but with 5 or 6 concentric lines and 3 radiating furrows.

The specimen thus agrees with *cornutus* in position of eye and plan of markings, with *agassizi* in length of pectorals and structure of scales, is intermediate in length of head, and agrees with neither in color of caudal and dorsal and tint of middle band. (*Forbes, in lit.* November 4, 1880.)

FAMILY XLIX.—CYPRINODONTIDÆ.

(*The Cyprinodonts.*)

Body oblong or moderately elongate, compressed behind, depressed forwards, covered with rather large cycloid scales, which are adherent and regularly arranged. No lateral line. Head scaly, at least above. Mouth terminal, small, the lower jaw usually projecting; margin of the upper jaw formed by the premaxillaries only; premaxillaries strong, extremely protractile. Teeth incisor-like or villiform, sometimes present on the vomer, but usually in the jaws only; lower pharyngeals separate, with cardiform teeth. Gill-membranes somewhat connected, free from isthmus; gill-rakers very short, thick. Branchiostegals 4–6. Pseudobranchiæ none. Dorsal fin single, inserted posteriorly, of soft rays only, rarely with a single spine or a rudimentary spinous dorsal; caudal fin not forked; ventral fins abdominal, rarely wanting; pectoral fins inserted low; no adipose fin. Stomach not cœcal, without pyloric appendages. Air-bladder simple, often wanting. Sexes usually unlike, the fins being largest in the males. Most or all are ovoviviparous, the young well developed at time of birth. Fresh-water fishes of Southern Europe, Asia, Africa, and America, some of them occurring in bays and arms of the sea. They are mostly of small size, and the species are very difficult of determination. Genera 30; species about 140.

(*Cyprinodontidæ* Günther, vi, 299–356.)

NOTE.—In the following analysis the genera known from Mexico are also included, their names being placed in *italics*.

* Intestinal canal comparatively short, little convoluted; teeth mostly fixed; dentary bones firmly joined. (*Carnivoræ.*)

a. Anal fin of the male not modified into an intromittent organ.

b. Teeth incisor-like, notched; insertion of dorsal nearly opposite ventrals. (*Cyprinodontinæ.*)

c. Teeth in a single series; body short and deep.

d. Dorsal very long, with 16–18 rays, the first spine-like...JORDANELLA, 156.

dd. Dorsal short, of 10–11 rays, the first ray small.....CYPRINODON, 157.

bb. Teeth all pointed; ventrals present. (*Fundulinæ.*)
e. Teeth in more than one series; air-bladder present.
f. Dorsal fin comparatively large and well forward, its rays usually more than 11 and the first ray usually in front of the anal.....FUNDULUS, 158.
ff. Dorsal fin small and posteriorly placed, its rays usually 7–10, and the first ray generally behind the front of the anal.
g. Anal fin small.....ZYGONECTES, 159.
cc. Teeth in one series; dorsal fin in advance of anal.
h. Dorsal and anal fins short, each with 9–13 rays.....LUCANIA, 160.
hh. Dorsal and anal fins long, each with more than 20 rays.
Girardinichthys.
aa. Anal fin of the male advanced, modified into a sword-shaped, intromittent organ. (*Anablepinæ.*)
i. Eye normal (*i. e.*, not divided into two portions by a horizontal partition); teeth in bands.
j. Jaws not produced.
k. Dorsal fin long, 14–16 rays.....*Pseudoxiphophorus.*
kk. Dorsal fin short, 9–10 rays.....GAMBUSIA, 161.
jj. Jaws much produced.....*Belonesox.*
** Intestinal canal elongate, with numerous convolutions; anal fin in the male usually modified into an intromittent organ; dentary bones loosely joined; teeth movable. (*Limnophagæ.*)
l. Teeth all pointed. (*Pœciliinæ.*)
m. Teeth in more than one row; dorsal more or less in advance of the anal, greatly enlarged in the male.
n. Caudal fin in the male with its lower lobe much produced; dorsal fin long, of 12 or more rays.
Xiphophorus.
nn. Caudal fin normal, alike in the two sexes.
o. Dorsal fin long, of more than 12 rays.
MOLLIENESIA, 162.
oo. Dorsal fin short, of less than 12 rays..PŒCILIA, 163.
mm. Teeth in a single series; dorsal fin short.
p. Dorsal inserted in advance of anal.
Platypœcilus.
pp. Dorsal inserted posteriorly to anal.
GIRARDINUS, 164.
ll. Teeth incisor-like, tricuspid (*Goodeinæ*).....*Goodea.*

156.—JORDANELLA Goode & Bean.

(Goode & Bean, Proc. U. S. Nat Mus. ii, 177, 1879: type *Jordanella floridæ* G. & B.)

Body short, deep, compressed. Head short. Mouth small, very protractile, the lower jaw the longer; lips full. Jaws each with a single series of rather broad, wedge-shaped, incisor teeth, the cutting edge of which is deeply notched, usually trifid. Branchiostegals 5. Dorsal fin elongate, the number of rays 16–18, the first being a robust spine; insertion of dorsal fin behind ventrals, in advance of front of anal, its last ray behind the last of anal; dorsal fin not greatly elevated. Anal fin shorter and smaller, similar in both sexes; ventral fins small, with a scale at base; caudal fin rounded; pectorals short and small. Intes-

tinal canal rather long; three times length of body. Sexes similar. (Dedicated to David S. Jordan.)

524. J. floridæ Goode & Bean.

Body ovate, short and deep, with elevated back, deep caudal peduncle, and steep profile. Head moderate, flat and broad between the eyes, its profile less steep than that of the back. Eyes large, $3\frac{1}{2}$–4 in head. Mouth small, anterior, the lower jaw projecting. Scales moderate, the humeral scale not much enlarged. Dorsal fin inserted midway between snout and base of caudal, its first ray robust and spine-like, grooved behind, longer than the diameter of the eye, and about as high as the succeeding soft rays. Fins all rather low, the ventrals reaching just past the vent. Scales with strong concentric striæ. Color olivaceous; sides orange or brassy, with a broad steely-blue stripe along each series of scales; 4 or 5 vague, diffuse, black vertical bars, most distinct in the young, nearly obsolete in the adult; a large, diffuse, dusky blotch on the sides, below the dorsal spine; fins mostly dark, the dorsal barred or speckled in the males, nearly plain in the females, sometimes a dusky blotch on its last rays; body and fins everywhere finely punctulate with black; a dark bar below eye. Head $3\frac{1}{2}$; depth 2–$2\frac{1}{4}$. D. I, 16, or I, 17; A. I, 11, to I, 13; Lat. l. 25–27; L. transv. 11 or 12. L. $1\frac{1}{2}$ inches. Streams of Central and Eastern Florida; abundant. The above description from specimens taken by Dr. J. A. Henshall in San Sebastian River. The original types were from Lake Monroe. Herbivorous, at least in part.

(Goode & Bean, Proc. U. S. Nat. Mus. ii, 117, 1879.)

157.—CYPRINODON Lacépède.

(*Lebias* Cuvier.)

(Lacépède, Hist. Nat. Poiss. v, 486, 1803: type *Cyprinodon variegatus* Lac.)

Body very short and stout, the back somewhat elevated. Mouth small. Snout short. Teeth moderate, incisor-like, tricuspid, in a single series. Scales very large; humeral scales usually enlarged. Dorsal fin moderate, inserted in advance of front of anal; its first ray not enlarged; anal smaller; ventral fins small. Intestinal canal little longer than body. Gill-membranes considerably united, free from the isthmus. Chubby little fishes, inhabiting the brackish waters of America, Southern Europe, and Northern Africa; sometimes living in hot salt springs. (κύπρινος, carp; ὀδών, tooth.)

525. C. variegatus Lac.

Body short and deep, the back considerably arched. Mouth as in the others, small and terminal. Humeral scale 4 times the size of the others. Eye longer than snout, $3\frac{1}{2}$ in head, less than interorbital space. Origin of dorsal about midway of body, behind ventrals in old specimens, rather in advance in the young; males with the dorsal fin elevated, but not reaching, when depressed, nearly to caudal. Male fish dusky, with only traces of bars; caudal fin with a dusky bar at base and on posterior edge; tips of dorsal and anal dusky; the scales in the breeding season with small tubercles. Female olivaceous; sides silvery, with darker bars and irregular markings; a dark bar at base of caudal; a dark spot on posterior part of dorsal. Head $3\frac{1}{4}$; depth $2\frac{1}{4}$. D. 10; A. 10; scales 25; L. transv. 11. L. ♂ $2\frac{1}{2}$ inches; ♀ $1\frac{1}{2}$ inches. Cape Cod to Mexico, in brackish waters, entering streams.

(Lacépède, Hist. Nat. Poiss. v, 486: *Lebias ovinus* DeKay, New York Fauna, Fish. 215; Günther, vi, 305: *Cyprinodon bovinus* B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 389: *Cyprinodon bovinus* Girard, U. S. Mex. Bound. Surv. Ichth. 67: *Cyprinodon bovinus* Günther, vi, 307: *Cyprinodon eximius* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 158.)

526. C. gibbosus Baird & Girard.

Similar to the preceding, but the body still deeper and the back and fins still more elevated; the scales apparently somewhat smaller; anal much smaller than dorsal; coloration similar to that of *C. variegatus*. Head $2\frac{3}{4}$; depth $1\frac{3}{4}$. D. 10; A. 11; Lat. l. 28; L. transv. 14. Indianola, Texas. (*Girard.*)

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 390; Girard, U. S. Mex. Bound. Surv. Ichth. 67.)

527. C. latifasciatus Garman.

Form and dentition of *C. gibbosus*. Black caudal band much wider; a light band from middle of opercle to lower half of caudal; a dark band above this, separated by a narrower band of light from the dark olive of the back; silvery color of belly separated from the light band on the flanks by a short band of brown; fins clouded with brown; caudal with a narrow dark band across its base and a broad one across its extremity. Head 4 in total length; depth 3. D. 12; A. 11; V. 6; P. 14; Lat. l. 30; L. transv. 11. Parras, Coahuila, Mex. (*Garman.*)

(Garman, Bull. Mus. Comp. Zoöl. viii, No. 3, 92, 1881.)

528. C. elegans Baird & Girard.

Body more elongate than in any of the preceding; the upper outline of the head less depressed, so that the profile is continuous; fins low, the dorsal quite small; its rays scarcely extending to the beginning of

the caudal peduncle. Bluish black, sides somewhat variegated with darker, the males somewhat spotted; edge of caudal fin black in the male; a black patch on last rays of dorsal in the female. Head $3\frac{1}{2}$; depth 2 to 3. D. 11; A. 10; scales 26–12. L. $2\frac{1}{2}$ inches. Rio Grande. (*Girard.*)

(Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 389; Girard, U. S. Mex. Bound. Surv. Ichth. 66.)

529. C. californiensis Grd.

"It may be easily distinguished from its congeners in North America, by its uniform system of coloration which exhibits neither bands nor spots. The general aspect of its body is rather short and deep, except in the young which assume a subfusiform appearance. The largest specimens which we have examined measure about an inch and a half in total length. The head constitutes the fourth of the length, the snout being abruptly rounded off. The mouth is, proportionally speaking, of medium size, whilst the eye is rather small, subcircular; its diameter entering three times and a half in the length of the side of the head. The dorsal fin is higher than long, and superiorly convex; its interior margin being nearer the apex of the snout than the posterior margin of the caudal. The anal fin is nearly as large as the dorsal, deeper than long, inferiorly convex, particularly upon its posterior half. The caudal is posteriorly truncated, nearly linear. The ventrals are small, project beyond the vent and reach almost the origin of the anal. The pectorals are well developed, rounded off, extending as far as a vertical line drawn at the insertion of the ventrals. The rays are: D. 10 + 1; A. 11; C. 3, 1, 8, 8, 1, 3; V. 7; P. 12. The scales are much deeper than long, anteriorly truncated and posteriorly rounded off or convex. The color is olivaceous brown, with a dark grayish tint along the back, and a golden tint beneath." (*Girard.*) San Diego, California.

(Grd. Proc. Acad. Nat. Sci. Phila. 1859, 157.)

530. C. macularius Baird & Girard.

Apparently very similar to *C. variegatus;* the female dark above, with dark bars on the sides and a dark shade across the dorsal fin; fins rather small. Head $3\frac{2}{3}$; depth 2–$2\frac{1}{2}$. D. 10; A. 11; scales 26–9. L. 2 inches. Rio Gila. (*Girard.*)

(B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 389; Girard, U. S. Mex. Bound. Surv. Ichth. 68.)

531. C. carpio Günther.

Slenderer than *C. variegatus;* humeral scale scarcely larger than the others; dorsal fin inserted slightly behind ventrals; eye $3\frac{1}{2}$ in head, a

little shorter than snout; olivaceous, silvery below. Head 3; depth 2½. D. 11; A. 10; scales 25–10. "America." (*Günther.*)

(Günther, vi, 306.)

158.—FUNDULUS Lacépède.

Killifishes.

(*Hydrargyra* Lacépède: *Xenisma* Jordan.)

(Lacépède, Hist. Nat. Poiss. v, 37, 1803: type *Fundulus mudfish* Lacépède = *Cobitis heteroclita* L.)

Body rather elongate, little elevated, compressed behind. Mouth moderate. Jaws, each with two or more series of pointed teeth, usually forming a narrow band. Bones of the mandible firmly united. Scales moderate. Branchiostegals 4–6. Preopercle, preorbital, and mandible with mucous pores. Dorsal and anal fins similar, moderately developed or rather large, the dorsal usually inserted in front of the anal. Ventrals well developed. Air-bladder present. Sexes differing in color, size, and development of the fins, the anal fin in the male normal. Intestinal canal short. Species very numerous, mostly American, inhabiting fresh waters and arms of the sea. They are the largest in size of the Cyprinodonts, and some of them are very brightly colored.

(Latin *fundus*, bottom, the supposed abode of the "*Fundulus mudfish.*")

The species may be divided as follows:

* Dorsal fin beginning in advance of anal.

† Branchiostegals 6. (HYDRARGYRA Lacépède.)

a. Males with dark cross-bars and a black dorsal spot; females with longitudinal stripes ..... *majalis, swampinus.*

aa. Males and females with dark cross-bars ..... *similis, zebra.*

aaa. Males without sharp markings, the scales rough in spring; females plain. *parvipinnis.*

†† Branchiostegals 5. (FUNDULUS.)

b. Dorsal long, its rays 16 or 17; body with round black spots, at least in the male ..... *seminolis.*

bb. Dorsal moderate, its rays 10–14.

c. Scales rather small, 40 or more in a longitudinal series.

d. Cross-bars if present, black ..... *diaphanus, confluentus.*

dd. Cross-bars silvery.

e. Teeth small, in a band ..... *menona.*

ee. Teeth in about two series, the outer enlarged ..... *adinia.*

cc. Scales large, less than 40 in a longitudinal series.

f. Males with 9 or 10 silvery cross-bars; females with black bars; fins plain ..... *nigrofasciatus.*

ff. Males with silvery spots and bars; females nearly plain olivaceous, or barred with black ..... *heteroclitus.*

** Dorsal fin beginning above or slightly behind anal; fins high. (XENISMA Jor.)

g. Branchiostegals 5; spots in regular series ..... *catenatus.*

gg. Branchiostegals 4; spots irregular ..... *stellifer.*

* Dorsal fin beginning in advance of anal.

† Branchiostegals 6. (*Hydrargyra** Lacépède.)

a Males with dark cross-bars; females with longitudinal stripes.

532. F. majalis (Walb.) Gthr.—*Killifish; Mayfish; Rockfish.*

Body oblong, scarcely elevated, little compressed; head rather prolonged anteriorly, the mouth small, terminal and very oblique; scales rather large; dorsal fin moderate; anal fin very high in the males, moderate in the females; ventrals long in the males, reaching past front of anal; eye moderate, shorter than snout and than interorbital space; a slight angle formed by the profile, in front of the eye, due to the greater flattening of the snout. Male fishes dark olivaceous above; sides silvery or somewhat golden, with about a dozen broad transverse bars of the color of the back; posterior part of dorsal fin with a black patch; fins yellowish or pale. Females olivaceous above, white below, a narrow black band along sides about on the level of the eye and as wide as the pupil; below this two similar black bars anteriorly and one posteriorly, the upper one being interrupted; one or two black bars at base of caudal. Females usually larger than the males. A large specimen taken at Beaufort, N. C., supposed to be a male of this species in high coloration, showed the following colors in life: Back olive, sides and belly bright salmon yellow; lower fins clear yellow; pectorals and anal with some dusky; posterior edge of caudal dark; dorsal nearly all black, a large black ocellated spot on the last rays; opercles and under parts of head with an inky suffusion; cheeks, top of head, and mouth bronze yellow; sides with about 18 narrow dusky vertical bars. Teeth in a broad band; an outer row of rather large teeth. Oviduct adnate to first anal ray for a short distance. Head $3\frac{3}{4}$; depth 4. D. 12; A. 10; Lat. l. 36; L. transv. 13. L. 5–6 inches. Cape Cod to Florida, the largest of our *Cyprinodontidæ;* abundant in shallow bays.

(*Cobitis majalis* Walbaum, Artedi, Pisc. 12, 1792: *Esox flavulus* Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 439; Giinther, vi, 322: *Hydrargyra majalis* C. & V. xviii, 207.)

533. F. swampinus (Lac.) Gthr.

Very similar to the preceding, but the scales apparently somewhat smaller; greenish olive, with a silvery longitudinal band, and 12-15 blackish vertical streaks. Head 4; depth $4\frac{1}{4}$. B. 6; D. 14; A. 12; Lat. l. 43. South Carolina. (*Val.*)

(*Hydrargira swampina* Lacépède, Hist. Nat. Poiss. v, 378; Günther, vi, 323.)

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* Lacépède, Hist. Nat. Poiss. v, 378, 1803: type *Hydrargira swampina* Lac. (ὑδορ, water; ἀργυρος, silver.)

aa. Males and females with dark cross-bars.

534. F. similis (Baird & Girard) Gthr.

Body moderately elongate. Head rather pointed and elongate, as in *F. majalis.* Sexes similarly colored; both olivaceous above; the sides silvery, with 10–15 dark vertical bars; males with an ocellated spot on the last rays of dorsal. Ventral fins short; insertion of dorsal midway between front of orbit and end of caudal. Head $3\frac{1}{3}$; depth 4. D. 11; A. 8 or 9; Lat. l. 33; L. transv. 13. Coast of Texas, ascending streams.

(*Hydrargyra similis* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 389: *Hydrargyra similis* Girard, U. S. Mex. Bound. Ichth. 68: *Fundulus similis* Günther, vi, 323; Jordan, Bull. U. S. Geol. Surv. Terr. iv, 400.)

535. F. zebra (Girard) Gthr.

Body elongate, compressed, subfusiform, the back slightly arched. Head subpyramidal, very much depressed. Eye 4 in head. Fins moderate; higher in the males than in the females. Scales smaller than in *F. similis* and more closely imbricated. Olivaceous above, with a blackish spot upon each scale; sides yellowish, with narrow transverse black bands or bars, about 16 in number, more conspicuous in the males than in the females, and extending from the back to the belly; interspaces wider than the dark bars. Fins plain. Sexes similar. Head $3\frac{3}{4}$. D. 13; A. 14. L. 3 inches. Rio Grande in New Mexico. (*Girard.*)

(*Hydrargyra zebra* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 60; Günther, vi, 324. Not of Dekay.)

aaa. Males without sharp markings; scales rough in spring. Females nearly plain.

536. F. parvipinnis Girard.

Male, light olive green, mottled with darker; sides with silvery and brassy lustre; lower parts yellow; about 20 short blackish cross-bars along middle of sides, broader, plainer, and more closely set behind; sides and fins with dark points; upper fins dull olive; lower yellow. Female larger, olive green above, sides not barred, with an obscure dusky lateral band on caudal peduncle. Fins plain. Fins very high in the male, small in the female. Scales large; in the males in spring roughened or ctenoid by small granulations and prickles, similar to the nuptial excrescences of some *Cyprinidæ;* fins also rough. Oviduct forming a sheath at base of first ray of anal. Head $3\frac{1}{2}$; depth $3\frac{2}{3}$. D. 13; A. 11; Lat. l. 38; L. transv. 12. L. 4 inches. Coast of California from Point Concepcion southward; very abundant in bays and lagoons.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 154; Girard, U. S. Pac. R. R. Surv. x, 303; Günther, vi, 319; Steindachner Ichth. Beiträge, v, 155, 1876.)

†† Branchiostegals 5. (*Fundulus.*)

b. Dorsal long; its rays 16 or 17.

537. F. seminolis Girard.

Body rather stout. Head subpyramidal, the snout tapering. Eye $4\frac{1}{2}$ in head. Dorsal fin high, its origin nearer apex of snout than origin of caudal; anal deeper than long. Ventrals not reaching vent. Scales deeper than long, of moderate size. Dark brown with large round black spots, the spots corresponding to the scales, upon their line of intersection. Dorsal and caudal spotted. Head $3\frac{2}{3}$; depth $3\frac{2}{3}$. D. 17; A. 13; V. 6. Florida. (*Girard.*)

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 59; Günther, vi, 325.)

bb. Dorsal moderate, its rays 11–14.

c. Scales rather small; more than 40 in a longitudinal series.

d. Cross-bars blackish.

538. F. diaphanus (Le S.) Ag.—*Spring Minnow.*

Body rather slender, not elevated, compressed posteriorly. Head moderate; quite flat above. Fins not large; dorsal and anal rather low; ventrals scarcely reaching vent in the females; somewhat longer in the males. General color olivaceous; sides silvery; 15–25 narrow, irregular blackish cross-bars on the sides; back always more or less spotted with blackish; fins nearly plain. Teeth pointed, the outer not much enlarged. Head 4; depth $4\frac{4}{5}$. Eye large, $3\frac{1}{2}$ in head. D. 13; A. 11; Lat. l. 40; L. transv. 12. L. 4 inches. Coasts, ascending all streams to their fountain heads. Abundant in various tributaries of the great lakes, Upper Mississippi, west to Colorado, and in ponds and streams of the Middle and Eastern States.

(*Hydrargyra diaphana* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 1817, 130: *Hydrargyra multifasciata* Le Sueur l. c. 131: *Fundulus multifasciatus* Günther, vi, 324, and of most writers; Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 67.)

539. F. confluentus Goode & Bean.

Yellowish, with a longitudinal streak along each row of scales and about 14 distinct irregular vertical dark bands. Head low, flat. Snout not produced. Interorbital space 2 in length of head, eye 4 in head. Origin of dorsal midway between tip of caudal and middle of eye. First ray of anal under second of dorsal. Anal higher than long. Scales crowded. B. probably 5. Head $3\frac{1}{2}$; depth $3\frac{4}{5}$. D. 10; A. 10; Lat. l. 45. Lake Monroe, Florida. (*Goode & Bean.*)

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 118.)

dd. Cross-bars silvery.

e. Teeth in bands, the outer not enlarged.

540. F. menona Jordan & Copeland.

Body elongate, slightly compressed, not elevated; head long and large, rather narrow above, the interorbital space half wider than eye, which is 4 in head. Dorsal moderate, inserted in advance of the anal, which is short and deep; paired fins short; vent midway between eye and base of caudal. Color (♂) dark olive brown, with about 16 shining, silvery, vertical bands, which are narrower than the dark interspaces; the interspaces broadest behind; fins plain; teeth pointed, curved, outer little enlarged. Head $3\frac{2}{5}$; depth 5. D. 12; A. 10; B. 5; scales 48–12. L. $3\frac{1}{2}$ inches. Rock River, Wisconsin.

(Jordan & Copeland, Proc. Acad. Nat. Sci. Phila. 1877, 68.)

ee. Teeth in about two series, the outer enlarged.

541. F. adinia J. & G. nom. sp. nov.

Body short, deep, and compressed; head moderate, broad, and flat above, the interorbital space rather more than half greater than the width of the eye; eye 4 in head; dorsal and anal fins rather large; dorsal inserted almost exactly over front of anal; teeth mostly in two series, the outer very strong; vent midway between eye and base of caudal; scales small, closely imbricated. Color olivaceous, with 15 to 20 silver cross-bars, almost as wide as the interspaces posteriorly, wider than the interspaces anteriorly, extending over the belly and joining their fellows on the opposite side; the bands variable, but usually wider and more crowded than in *F. menona;* fins plain. Head $3\frac{2}{3}$; depth 4. D. 13; A. 11; scales 44–15. L. 2 inches. Coast of Texas, ascending streams; our specimens from the Rio Grande.

(? *Adinia multifasciata* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 117: *Fundulus zebra* Jordan, Bull. U. S. Geol. Surv. Terr. iv, No. 2, 1878, 664. Not *Hydrargyra multifasciata* Le Sueur, nor *Hydrargyra zebra* Grd., nor *Fundulus zebra* Dekay.)

cc. Scales rather large, less than 40 in a longitudinal series.

f. Males with 9 or 10 silvery cross-bars; females with black vertical stripes; fins plain.

542. F. nigrofasciatus (Le S.) C. & V.

Body rather short and deep; head rather long and depressed; the snout obtuse, a slight angle being formed above the eye; dorsal moderate, well back; anal short and deep; eye longer than snout, $1\frac{1}{2}$ in interorbital space, $3\frac{1}{3}$ in head. Olivaceous above, silvery below; fins in both sexes immaculate; males with 9 or 10 very distinct silvery

cross-bars, each about as broad as a scale; females with about as many narrow black bars, which do not extend on the back or belly; scales punctate. Head $3\frac{2}{3}$; depth 4. D. 11; A. 9; scales 33–11. L. $2\frac{1}{2}$ inches. (*Günther.*) Atlantic coast of United States, not very common.

(*Hydrargyra nigrofasciata* Le Sueur, Journ. Acad. Nat. Sci. Phila. 1817, i, 133; Storer, Fish Mass, 295; Günther, vi, 325.)

ff. Males with silvery spots and bars; females nearly plain olivaceous; fins spotted.

543. F. heteroclitus (L.) Günther.—*Common Killifish; Mummichog; Salt-water Minnow.*

Body thick-set, short and deep; anteriorly broad, posteriorly compressed, the back elevated; head rather short, blunt, broad and flat on top; eye moderate, about equal to snout, about half the width of interorbital space and one-fifth of the length of the head; fins moderate, the dorsal inserted in males midway between snout and tip of caudal; in females farther back; oviduct attached to anterior ray of anal fin, its opening near the tip of the ray; teeth in broad bands, pointed, the outer series enlarged. Coloration in males dark dull green, the belly more or less orange yellow; sides with numerous quite narrow ill-defined silvery bars made up of spots, most distinct posteriorly; besides these are numerous conspicuous white or yellow spots, irregularly scattered; vertical fins dark, with numerous small round pale spots; dorsal often with a blackish spot on its last ray; anal and ventrals yellow anteriorly; under side of head yellow; young males sometimes with dark bars. Females nearly plain olivaceous, lighter below, without spots or bars, the scales finely punctate; sides sometimes with a few faint vertical shades. Head $3\frac{2}{3}$; depth $3\frac{2}{3}$. D. 11; A. 11; scales 36–13; L. 3–5 inches. Maine to Mexico, everywhere very common in brackish waters, the most abundant of our *Cyprinodontidæ*. Southern specimens perhaps reach a larger size (var. *grandis*) than northern, and some specimens (var. *pisculentus*) have the head wider than usual.

(*Cobitis heteroclita* L. Syst. Nat.: *Esox pisculentus*, Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 441: *Fundulus pisculentus* of most American authors: *Fundulus zebra* Dekay, N. Y. Fauna, Fish. 218, 1842: *Fundulus grandis* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 389: *Fundulus grandis* Girard, U. S. Mex. Bound. Surv. Ichth. 69: *Fundulus floridensis* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 157: *Fundulus pisculentus* Storer, Fish. Mass. 294; Günther, Cat. Fish. Brit. Mus. vi, 318.)

** Dorsal fin beginning directly above or slightly behind anal. (*Xenisma** Jor.)

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*Jordan, Bull. Buff. Soc. Nat. Hist. 1876, 142: type *Xenisma stellifera* Jor. (ξένισμα, a surprise.)

g. Branchiostegals 5; spots in regular series.

544. F. catenatus (Storer) Gthr.—*Stud-fish.*

Similar in form to *F. stellifer*, but larger, with lower fins and different coloration; dorsal and anal fins even in the males, falling short of the caudal; color bluish or greenish, with a round orange spot (in the male) on each scale, thus forming series of regular lines of dots; females with smaller brown spots on the scales, also forming lines. Anal prickly in spring males. Teeth in broad bands, the outer somewhat enlarged. Head 4; depth 4½–5. D. 14; A. 15; Lat. l. 50. L. 6 or 7 inches. Tennessee and Cumberland Rivers, locally abundant, one of the largest and handsomest of the Cyprinodonts.

(*Pœcilia catenata* Storer, Synopsis Fish N. A. 1846, 430; Günther, vi, 322; Cope, Journ. Acad. Nat. Sci. Phila. 1868, 238: *Xenisma catenata* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 322.)

gg. Branchiostegals 4; spots irregular.

545. F. stellifer Jordan.—*Spotted Stud-fish.*

Body rather long, somewhat compressed. Head broad and flattened above, in the usual fashion. Eye large, about 4 in head. Scales closely imbricated, deeper than long. Dorsal fin beginning slightly behind anal, its last rays in the adult males highly elevated, reaching the base of caudal, their height equal to the depth of the body; anal similar, more elevated in front and less so behind, the last rays falling just short of caudal; fins lower in females and young; pectorals reaching ventrals, the latter to anal in the males. Teeth in a narrow band, the outer somewhat enlarged, blunt and curved. Coloration brilliant; livid blue above, somewhat silvery below; body and cheeks, with large, bright dark orange spots, irregularly placed, not following the rows of scales, and not always in the middle of the scales; these spots not uniform in size; females with olive-brown spots horizontally, oblong and smaller than the orange spots of the males and more regularly placed; a blue loral blotch, with a green one below it; a pale yellow blotch on the back in front of the dorsal, very conspicuous when the first anal ray. Head 3¾; depth 5. D. 13; A. 13; V. 6; Lat. l. 53. L. fish is in the water, but fading in spirits. Oviduct not extending on 3–4 inches. Alabama River, in clear streams and springs; a beautiful fish.

(*Xenisma stellifera* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 322.)

159.—ZYGONECTES Agassiz.

Top Minnows.

(*Micristius* Gill.)

(Agassiz, Am. Journ. Sci. Arts, 1854, 135: type *Pœcilia olivacea* Storer.)

This genus is closely related to *Fundulus*, differing chiefly in the small size and posterior position of the dorsal, which has usually less than ten rays and is commonly inserted behind the front of the anal fin. The species are smaller in size than those of *Fundulus*, and different in appearance, so that we feel reluctant to unite the two genera, although the technical differences are very slight. From the Old World genus *Haplochilus*, *Zygonectes* is distinguished by the short anal fin. The females of *Zygonectes* are scarcely distinguishable from those of *Gambusia*. Species all American. Surface swimmers, feeding upon insects.

(*ζῦγόν*, yoke; *νήκτης*, swimmer; they being said to swim in pairs.)

* Body rather elongate. (*Zygonectes.*)

a. Sides without black band.

546. Z. rubrifrons Jordan.

Body moderately stout, little compressed, not elevated, the caudal peduncle deep; head rather long, broad between the eyes, flat above; eyes large, 3½ in head, their range horizontal; mouth rather large. Teeth small, nearly even, in a narrow band. Scales moderate. Dorsal fin very short and small, placed a little behind the anal or about even with it, its position in the males rather more posterior; anal short, high in the males; ventrals very small; pectorals small. Color, males dark olivaceous, with a dark, bronze-orange spot on each scale posteriorly, much as in *Fundulus catenatus*. Below, these spots are bright orange. Faint, narrow vertical, orange bars along the lower and posterior part of the body. Vertical fins with orange spots. Jaws and space in front of eyes bright orange-red; paired fins dusky. Females almost uniform brassy-olivaceous, without evident spots or red markings. Head 3¼ in length to base of caudal; depth 3¾. D. 7 or 8; A. 8 or 9; Lat. l. 32; L. transv. 11 or 12; B. 5. L. 2½–3 inches. San Sebastian River, Florida, a larger species than most in the genus, and with the dorsal fin less posterior.

(Jordan, Proc. U. S. Nat. Mus. 1879, 237.)

547. Z. henshalli Jordan.

Body rather stout, deep and compressed, the profile nearly straight, the back little elevated, and the caudal peduncle deep; head moderate;

mouth rather large; jaws each with a series of long and rather slender canine-like teeth, behind which is a band of small teeth; the canines larger in the lower jaw; eye large; scales rather large; dorsal fin short and high, inserted slightly behind the anal in the males, exactly opposite it in the females; caudal large; anal fin larger and rather lower than dorsal; ventrals quite small; pectorals moderate. General color olivaceous; sides covered, especially posteriorly, with rather large, irregularly placed orange spots, which also extend on the vertical fins; dorsal dusky, with a dark bar; head without red; caudal and anal more or less yellow; females obscurely marked; young with diffuse greenish vertical bars. Head $3\frac{1}{2}$ in length to base of caudal; depth 4. B. 5; D. 7 or 8; A. 10 or 11; Lat. l. 33; L. transv. 10. L. 3–4 inches. San Sebastian River, Florida. The largest species of the genus, looking like a *Fundulus*.

(Jordan, Proc. U. S. Nat. Mus. 1879, 327.)

548. Z. floripinnis (Cope) Jor.

General form of *Z. notatus;* lower jaw somewhat projecting; external series of teeth in both jaws enlarged; eye large, $3\frac{1}{5}$ in head. Olive gray, scales with ochre borders; fins yellow, broadly edged with crimson. Head $4\frac{1}{8}$; depth 5. D. 10; A. 13; scales 29–10. L. $2\frac{1}{2}$ inches. Rivers of Colorado. (*Cope.*)

(*Haplochilus floripinnis* Cope, Zoöl. Lieut. Wheeler's Expl. W. 100th Mer. v, 695, 1876.

549. Z. lineatus Garman.

Brownish, finely punctulate with brown; white below; lips, top of head, and a line along middle of back dark; tail with faint transverse bands. Moderately stout, compressed. Crown flat. Eye large, as long as snout, $1\frac{3}{4}$ in interorbital width. Lower jaw slightly longer. Outer teeth long, slender, curved. First ray of dorsal almost opposite first of anal, one-third the distance from base of caudal to front of eye; caudal truncate. Head nearly 3; depth $4\frac{1}{4}$. D. 11; A. 14; V. 6; P. 15; Lat. l. 36; L. transv. 12. Northeastern Wyoming. (*Garman.*)

(Garman, Bull. Mus. Zoöl. viii, No. 3, 88, 1881.)

aa. Sides with a broad, dark lateral band; fins plain or speckled.

550. Z. notatus (Raf.) Jor.—*Top Minnow.*

Body rather slender, compressed behind. Head low, depressed, and rather elongate, the snout somewhat produced, the lower jaw scarcely projecting; interorbital space broad, its width about half length of head; eye large, less than snout, about 3 in head. Fins moderate, the

dorsal and anal elevated in the males. Teeth in a broad band, the outer series considerably enlarged and canine-like. Coloration brownish olive, with a broad, dark purplish-black lateral band running from tip of snout through eye to base of caudal; darker in males than in females; young specimens have the edges of the band serrated; a few series of small black dots along the sides of the back; dorsal, caudal, and anal fins dotted with black; top of head with a conspicuous translucent spot in life; concentric striæ on scales, strong. Head 4; depth $4\frac{1}{2}$. D. 9; A. 11; scales 34–11. L. 2–$3\frac{1}{2}$ inches. Michigan to Alabama and Texas, generally abundant in ponds and canals.

(*Semotilus? notatus* Raf. Ich. Oh. 1820, 86: *Pœcilia olivacea* Storer, Synopsis, 178: *Fundulus tenellus* B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 389: *Zygonectes pulchellus* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 60: *Fundulus aureus* Cope, Proc. Acad. Nat. Sci. Phila. 1865, 78: *Haplochilus pulchellus* Günther, vi, 314: *Haplochilus aureus* Günther, vi, 315; Jordan, Man. Vert. 264.)

** Body short and deep. (*Micristius* Gill.)

551. Z. atrilatus Jordan & Brayton.

Body short and stout, compressed, especially posteriorly. Head moderate, broad and flattened above. Dorsal fin well back, moderately high; anal fin rather larger; paired fins small. Coloration dull olive; no stripes or bars; scales slightly dark-edged; a large jet-black blotch on each side just above and somewhat in front of the vent, due to the black peritoneum showing through the translucent sides; dorsal and anal fins speckled. Teeth small, the outer little enlarged. Head 4; depth 4. D. 8; A. 8; scales 30. L. $1\frac{3}{4}$ inches. Neuse River, North Carolina.

(Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 1878, 84.)

552. Z. melanops (Cope) Jor.

Body rather short and deep. Head broad; eye as long as snout, $3\frac{1}{2}$ in head, 2 in interorbital width; teeth in a band, the outer series scarcely enlarged. Fins short. Yellowish brown; scales darker edged; body without distinct longitudinal stripes or bars; belly golden; a very conspicuous jet-black spot just below the eye, and confluent with it in the adult; dorsal and caudal fins with series of black dots; caudal very large. Head $3\frac{2}{3}$; depth $3\frac{1}{2}$. D. 7; A. 9; scales 28–7. L. $2\frac{1}{2}$ inches. Neuse River (*Cope*) to Southern Illinois (*Forbes*) and Mississippi (*Hay*), locally abundant.

(*Haplochilus melanops* Cope, Proc. Amer. Phil. Soc. 1870, 457; Jordan, Bull. Ill. Lab. Nat. Hist. ii, 52, 1878; Hay, Proc. U. S. Nat. Mus. 1880, 501.)

553. Z. dispar * Agassiz.

Body short and deep, much compressed. Head short and very broad, the flat interorbital space being two-thirds of its length, and barely twice the diameter of the eye; the distance between the eyes above greater than the distance between them below. Snout broadly rounded. Fins moderate; dorsal much smaller than anal. Outer series of teeth somewhat enlarged. Coloration pale olive, bluish in life; a very distinct brownish line along the edges of each row of scales, appearing wavy or serrated as it follows the scales; about 10 of these longitudinal stripes are present; males with the lines interrupted, appearing as series of dots and further marked by about 9 dark cross-bars; adults with a dark blotch below the eye, sometimes confluent with it. Oviduct free from anal. Head $3\frac{3}{4}$; depth $3\frac{1}{2}$. D. 7; A. 9; scales 35–10. L. $2\frac{1}{2}$ inches. Lakes and sluggish streams from Ohio to Iowa.

(Agassiz, Amer. Jour. Sci. Arts, 1854, 353; Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 67.)

554. Z. brachypterus Cope.

"Base of the first dorsal ray behind the vertical line equally dividing the base of the anal; ventrals not reaching base of anal. Scales large. Head wide, with overhanging supercilia; interorbital width twice the diameter of the orbit, which enters the length of the head $2\frac{1}{2}$ times. Color uniform olivaceous, the scales with brown edges; cheeks silvery; no spots on the head. Body stout. Head $4\frac{1}{2}$. D. 7; A. 8. Scales 30–9. Length 2." (*Cope*, MSS.) Trinity River and other streams in Texas.

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* Professor Agassiz, Amer. Journ. Sci. Arts, 1854, 353, mentions three more species of this genus, which have not since been recognized, besides two (*Z. lateralis* and *Z. zonatus*) which are evidently identical with *Z. notatus*, and another, *Z. lineolatus*, which Professor Putnam informs us is identical with *Z. nottii*.

Z. nottii Agass.

"The darker continuous longitudinal lines alternate with fainter interrupted ones. Males with distinct transverse bands; dark olive above, fading upon the sides; silvery below. Operculum, throat, and space in advance of the eye orange color." Mobile, Ala.

Z. guttatus Agass.

"A large dark spot upon the centre of each scale on the back and sides, forming longitudinal rows of disconnected dots. The transverse bars of the male are much narrower and nearer together than in *Z. lineolatus* (*nottii*). Dark olive above, fading upon the side. Abdomen silvery." Mobile, Ala.

Z. hieroglyphicus Agass.

"Anterior and upper parts of the body sprinkled with dark dots, passing into longitudinal rows backwards. Light olive above; silvery on the sides and below." Mobile, Ala.

555. Z. sciadicus (Cope) Jor.

Body short and stout. Eye equal to snout, $3\frac{1}{2}$ in head, $1\frac{2}{3}$ in interorbital space. Fins small. Coloration uniform olivaceous, without spots or lines. Head $3\frac{1}{2}$. D. 10; A. 12; scales 39–13. L. 2 inches. Platte River. (*Cope.*)

(*Fundulus sciadicus* Cope, Proc. Acad. Nat. Sci. Phil. 1865, 78: *Haplochilus sciadicus* Günther, vi, 316.)

556. Z. chrysotus (Günther) Jor.

Head depressed anteriorly. Snout shorter than the eye, which is $3\frac{1}{3}$ in head and $1\frac{1}{2}$ in interorbital space. Fins moderate. Light olive-colored, with narrow, dark, vertical streaks on the sides; caudal with bands of brown dots. Head $3\frac{1}{2}$; depth 4. D. 9; A. 11; scales 34–12. Charleston, S. C. (*Günther.*)

(*Haplochilus chrysotus* Günther, vi, 317.)

557. Z. zonatus (Mitch.) Jor.

Eye large, $2\frac{1}{2}$ in head. Dorsal almost reaching the caudal, which is lanceolate. Sides with 12 black cross-bars; dorsal and anal dotted with black; other fins immaculate. D. 7; A. 10. Head $4\frac{1}{2}$ in total length. South Carolina. (*Günther.*)

(?*Esox zonatus* Mitch. Trans. Lit. & Phil. Soc. i, 443: *Fundulus zonatus* C. & V. xviii, 196: *Haplochilus zonatus* Günther, vi, 316.)

558. Z. cingulatus (C. &. V.) Jor.

Anal rather larger than dorsal; sides with ten or twelve broad, well-defined, vertical dark bars, nearly as broad as their interspaces; dorsal with a large black spot posteriorly, immediately in front of which is a white one; other fins immaculate. D. 8; A. 9. Head $3\frac{3}{4}$. Coast of New Jersey. (*Günther.*)

(*Fundulus cingulatus* C. & V. xviii, 197 (D. 8; A. 10): *Hydrargyra luciæ* Baird, Ninth Smithsonian Rept. 1855, 344: *Haplochilus luciæ* Günther, vi, 316.)

160.—LUCANIA Girard.*

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 118: type *Lucania venusta* Grd.)

Mouth moderate, the snout not produced; both jaws with a single series of conical teeth. Scales rather large. Dorsal and anal rays in moderate number, the dorsal in advance of the anal; anal fin not modified in the males. Very small fishes. (A coined name without meaning.)

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* GIRARDINICHTHYS Bleeker.

(*Limnurgus* Günther.)

(Bleeker, Cyprin. 1860, 481: type *Girardinichthys innominatus.*)

Body stout. Mouth small, the upper jaw very protractile. Teeth small, subcylindrical, in a single series in each jaw. Scales rather small. Dorsal and anal fins long,

559. L. venusta Grd.

Body oblong, much as in *Zygonectes*. Dorsal midway of body, moderately elevated, much in front of anal. Snout rather pointed. Brownish, slightly spotted. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. 13; A. 11; Lat. l. 27. L. $1\frac{1}{2}$ inches. Indianola, Tex. (*Girard.*)

(*Limia venusta* Girard, U. S. Mex. Bound. Surv. Ichth. 71, 1859; Girard, Proc. Acad. Nat. Sci. Phila. 1859, 118; Günther, vi, 310: *Lucania affinis* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 118.)

560. L. parva (B. & G.) Bean.*

Form elongated. Head less than one-fourth the length (with the caudal). Eye 3 in head. Coloration plain. D. 10; A. 10; V. 6; L. transv. 8. Very small. Long Island. (*Günther.*)

(*Cyprinodon parvus* B. & G. Ninth Smithsonian Report, 1855, 345: *Cyprinodon parvus* Günther, vi, 307.)

561. L. goodei Jordan.

Body elliptical, rather elongate, the back considerably elevated to a point just in front of the origin of the dorsal fin; the caudal peduncle rather deep and compressed. Head short, comparatively narrow, and bluntly pointed. Mouth small, terminal; both jaws with rather large conical canine-like teeth, apparently in a single series. Eye large, near the middle of the side of the head, its diameter contained $2\frac{1}{2}$ to $2\frac{3}{4}$ times in the length of the head, about equal to the width of the interorbital space. Scales large, their exposed surfaces higher than long, in about 30 (29 to 32) longitudinal and 7 vertical series; humeral scale like the others. Fins large, especially in the males; origin of dorsal about midway between snout and base of caudal, conspicuously in advance of anal; height of dorsal fin in the males two-thirds the length of the head, about equal to the length of the base of the fin; anal fin similar and nearly as high and long, beginning nearly under the middle of the dorsal; caudal moderate, subtruncate; ventrals long, in the males

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each with 20 or more rays, nearly opposite each other; anal fin not modified in the male. Intestinal canal short. Mexico. (Girardinus; ἰχθυς, fish.)

G. innominatus Bleeker.

Head thick, the snout obtuse, the mandible being directed vertically upward; neck arched so that the upper profile of the head is concave. Eye 5 in head, $\frac{1}{2}$ the width of interorbital space. Olivaceous, with brown cross-bands, which are sometimes confluent. Head 4; depth $3\frac{1}{4}$. D. 20; A. 22; Lat. l. 44. Vicinity of city of Mexico. (*Günther.*)

(*Lucania* sp. Girard, Proc. Acad. Nat. Sci. Phila. 1859, 114; Bleeker, Cyprin. 484: *Limnurgus variegatus* Günther, vi, 309.)

*Dr. Bean informs us that this species, the types of which he has examined, is a *Lucania*.

reaching the front of the anal, in the females reaching the vent; pectorals reaching past front of ventrals in both sexes. Color olivaceous, the scales with dark edgings; a very distinct black band in both sexes running through eye and snout straight to the base of the caudal, where it ends in a round black spot; this band is about as wide as a series of scales, although developed on parts of two series; a conspicuous black band in both sexes along the lower edge of the caudal pedunncle, from the root of the caudal to the vent, dividing and passing on each side of the anal fin; fins in the female plain; in the male, basal half of dorsal and anal jet black, outer half pale with a black edge; pectorals and especially ventrals also dark-edged; caudal fin faintly mottled; vertical fins with more or less red in life. Head 4; depth $4\frac{1}{4}$. D. 9; A. 9. L. $1\frac{1}{4}$ inches. Arlington River, Florida, a tributary of the Saint John's.

(Jordan, Proc. U. S. Nat. Mus. 1879, 240.)

161.—GAMBUSIA Poey.*

(*Heterandria* Agassiz.)

(Poey, Mem. Cuba, i, 382, 1851: type *Gambusia punctata* Poey, from Cuba.)

Body moderately elongate. Mouth medium; both jaws with a band of conical teeth; snout not produced; the lower jaw prominent. Eyes

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* PSEUDOXIPHOPHORUS Bleeker.

(*Pœciliodes* Steindachner.)

(Bleeker, Ichthyol. Ind. Prodr. Cypr. 1860, 483: type *Xiphophorus bimaculatus* Heckel.)

This genus has the general characters of *Gambusia*, differing in the larger size of the dorsal fin, which has 14–16 rays instead of 6–10. Mexico. (*ψευδος*, false; *Xiphophorus*.)

* Anal process ending in a small hook.

P. bimaculatus (Heckel) Günther.

Each scale with a brown crescent; a black spot behind upper end of gill-opening, and a round blackish spot on upper half of root of caudal. Head $4\frac{1}{2}$; depth $4\frac{1}{4}$. B. 6; D. 14; A. 10; scales 29–8. L. 4 inches. Mexico. (*Günther.*)

(*Xiphophorus bimaculatus* Heckel, Sitzgsber. Akad. Wiss. Wien, 1848, 169; Günther, vi, 332.)

** Anal process without hook.

P. reticulatus Troschel.

Coloration as in the preceding; caudal fin entirely blackish. Depth 6 in total length. D. 16; A. 8. Mexico. (*Günther.*)

(Troschel, Müller's Reise Mexico, iii, App. 104; Günther, vi, 333.)

BELONESOX Kner.

(Kner, Sitzgsber. Akad. Wiss. Wien, 1860, xl, 419: type *Belonesox belizanus* Kner.)

Cleft of the mouth much developed laterally, the jaw bones being much produced. The intermaxillaries form together an elongate triangular plate, but are not anchy-

normal. Scales large. Dorsal and anal fins both rather short, the anal more or less in advance of the dorsal; anal fin of the male modified into a long intromittent organ, and much advanced. Intestinal canal short. Branchiostegals 6. Small fishes inhabiting the fresh waters of Mexico, Cuba, and the Southern States. The numerous species are imperfectly known.

("The name owes its etymology to the provincial Cuban word *Gambusino*, which signifies *nothing*, with the idea of a joke or farce. Thus one says 'to fish for *Gambusinos*' when one catches nothing."—*Poey*.)

562. G. patruelis (B. & G.) Girard.

Snout broad, subspatulate, the lower jaw projecting. Eye longer than snout, 3 in head, $1\frac{1}{2}$ in interorbital space. Anal process in ♂ longer than head, not curved at its extremity. Caudal peduncle rather elongate. A faint dark line across upper part of trunk; sometimes series of dark dots on sides of body; an oblique dark band below orbit; caudal with dark spots; coloration sometimes uniform. Head $3\frac{2}{3}$; depth 4. D. 8; A. 9; scales 32–8. South Carolina to Mexico; abundant in lowland streams.

(*Heterandria holbrooki* Agassiz MSS.: *Gambusia holbrooki* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 61: *Gambusia holbrooki* Günther, vi, 334: *Heterandria patruclis* B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390; Girard, U. S. Mex. Bound. Surv. Ichth. 72.)

563. G. humilis Günther.

Slender; anal larger than dorsal, and much anterior to it. Olive; dorsal and caudal with narrow blackish cross-bars. Head $4\frac{1}{4}$. D. 6; A. 9. Matamoras. (*Girard.*)

(*Gambusia gracilis* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 121, preoccupied; Günther, vi, 335.)

564. G. arlingtonia Goode & Bean.

Uniform brownish olive; fins with a few blackish dots. Snout broad. Lower jaw projecting. Eye longer than snout, 3 in head. Dorsal inserted midway between posterior margin of eye and tip of tail. Pectorals reaching ventrals; ventrals to vent. Head $3\frac{1}{3}$; depth 4. D. 9; A. 11; V. 6; Lat. l. 33; L. transv. 11. Arlington River, Florida; known from females only, and very likely a *Zygonectes*.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 118.)

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losed together. Mandible long, somewhat prominent; both jaws with a broad band of cardiform teeth. Scales rather small. Anal in advance of dorsal, modified in the male into an intromittent organ. Branchiostegals 6. Intestinal canal short. Carnivorous. Mexico. (Belone; Esox.)

B. belizanus Kner.

Slender. Olivaceous; sides with series of brown dots; a black spot at root of caudal. Head 3; depth $5\frac{1}{2}$. D. 9; A. 10; scales 60–18. Mexico and Central America. (*Kner.*)

(Kner, l. c.; Günther, vi, 333.)

565. G. affinis (B. & G.) Grd.

Body moderately stout. Dorsal and anal fins similar in size and shape, the latter not much advanced. Coloration plain; dorsal and caudal dotted with black. Head 4; depth $3\frac{4}{5}$. D. 6; A. 8. Texas. (*Girard.*)

(*Heterandria affinis* B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390; Girard, U. S. Mex. Bound. Surv. Ichth. 72; Günther, vi, 336.)

566. G. nobilis B. & G.*

Body very deep, elevated in front of dorsal. Anal much smaller than dorsal. Ventrals very small. Coloration plain. Head $3\frac{1}{2}$; depth $3\frac{1}{3}$. D. 8; A. 7. L. $2\frac{1}{2}$ inches. Texas. (*Girard.*)

(*Heterandria nobilis* B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390; Girard, U. S. Mex. Bound. Surv. Ichth. 71; Günther, vi, 335.)

(Two other species from the Rio Grande region, *G. speciosa* and *G. senilis*, are briefly and probably unrecognizably described by Girard, Proc. Acad. Nat. Sci. Phila. 1859, 121).

162.—MOLLIENESIA Le Sueur.†

(*Limia* Poey.)

(Le Sueur, Journ. Acad. Nat. Sci. Phila. ii, 1821, 3: type *Mollienesia latipinna* Le Sueur.)

Body rather stout. Mouth small; mandible very short, its bones not united, the dentary being movable; both jaws with a narrow band of small teeth, besides an outer series of long, slender, movable teeth, which are curved and slightly compressed, placed on the outer edge of the jaw. Branchiostegals usually 5. Scales rather large. Anal fin

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* *G. gracilis* (Heckel) Gthr.

Anal process twice as long as head; the extremity bent. A dark band from upper end of gill-opening to the caudal. Head 4; depth 4. D. 8; A. 9; scales 29–7. Orizaba, Mexico. (*Günther.*)

(*Xiphophorus gracilis* Heckel, Sitzgsber. Akad. Wiss. Wien, 1848, i, pt. 3, 300; Günther, vi, 336.)

†XIPHOPHORUS Heckel.

(Heckel, Sitzgsber. Akad. Wiss. Wien, 1848, i, pt. 3, 163: type *Xiphophorus helleri* Heckel.)

This genus differs from *Mollienesia* chiefly in the structure of its caudal fin, the lower rays of which in the males are prolonged into a long sword-shaped appendage, which in the adult is sometimes as long as the rest of the fish. Anal of the male modified into an intromittent organ, one or two of the enlarged rays being provided with hook-like processes. Branchiostegals 5. (ξιφος, sword; φορεω, to bear.)

X. helleri Heckel.

Sides with blue and yellowish-green bands or dark spots. Prolonged caudal appendage of the male nearly as long as the body, yellow, with black edges. Anal process with numerous hooks. Head $4\frac{1}{3}$; depth $3\frac{3}{4}$. B. 5; D. 13; A. 9; scales 29–8. Mexico. (*Günther.*)

(Heckel l. c.; Günther, vi, 349.)

behind the dorsal, the anal of the male being modified into an intromittent organ; caudal fin alike in the two sexes; dorsal fin highly elevated in the male, its base elongate, of twelve or more rays. Intestines elongate, with numerous convolutions. Small mud-eating fishes, of variegated colors, found in Cuba, Mexico, and our Southern States. (Dedicated to Monsieur *Mollien*, French minister of finance, a patron of Péron, the friend and scientific associate of Le Sueur.)

567. M. latipinna Le Sueur.*

Body short and deep, compressed. Eye equal to snout, $3\frac{1}{2}$ in head, 2 in interorbital space. Inner teeth almost obsolete; outer series large, freely movable. Dorsal fin in the males greatly elevated, in the females moderate. Greenish, silvery below; a row of dark spots along each series of scales, and the lower part of the trunk also with a series of round brown spots; each scale with a silvery hinder margin; dorsal fin in ♂ with 4 or 5 brown lines interrupted by the rays, and with a row of vertically ovate spots on its upper half; caudal membrane with black dots, the lower half of its hinder margin black. Female less spotted. Head $3\frac{3}{4}$; depth $3\frac{1}{8}$. B. 5; D. 13; A. 7; scales 27–8. L. $2\frac{1}{2}$ inches. Florida to Mexico; abundant in streams of the lowlands.

(Le Sueur, Journ. Acad. Nat. Sci. Phila. 1821, ii, 3; Günther, vi, 348: *Pœcilia multilineata* Le Sueur, l. c. 4: *Pœcilia lineolata* Grd. U. S. Mex. Bound. Surv. Ichth. 70: *Limia pœcilioides* Grd. U. S. Mex. Bound. Surv. Ichth. 70: *Limia matamorensis* Grd. Proc. Acad. Nat. Sci. Phila. 1859, 116.)

163.—PŒCILIA Bloch & Schneider.

(*Limia* Poey.)

(Bloch & Schneider, Systema Ichthyologiæ, 1801, 452: type *Pœcilia vivipara* Bloch & Schneider, from Surinam.)

This genus differs from *Mollienesia* only in the smaller size of the dorsal, which has usually nine or ten rays and is nearly opposite the anal in the female, but behind it in the male. The numerous species

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* *M. formosa* (Grd.) Gthr.

Body rather stout. Snout short. Fins different in the two sexes. Olivaceous, scales with brown spots; dorsal fin with transverse series of blackish spots; other fins immaculate. Head $3\frac{1}{4}$; depth $3\frac{1}{4}$. D. 12; A. 10. Palo Alto, Mexico. (*Girard.*)

(*Limia formosa* Grd. Proc. Acad. Nat. Sci. Phila. 1859, 115; Günther, vi, 349.)

M. jonesi Gthr.

Brownish, each scale with a black margin; a black band between eye and scapula; a round black spot on upper half of root of caudal; anal with a black line along each ray; other fins plain. Eye shorter than snout, 4 in head, 2 in interorbital width. Dorsal (in female) much longer than high; anal small, opposite middle of dorsal. D. 12; A. 10; Lat. l. 29; L. transv. 9. Volcanic lake, Huamantla, Mexico. (*Günther.*)

(Günther, Ann. Mag. Nat. Hist. xiv, 370, 1874.)

inhabit the West Indies, Mexico, and South America. (*ποικιλος*, variegated.)

* Branchiostegals 5. (*Pœcilia.*)

568. P. couchiana (Girard) Jor. & Gilb.

Body short, back convex; head small; scales very large. Brownish, each scale with a large brown spot; an obscure black lateral band; fins plain, except the dorsal, which has a few black spots. Head 4. D. 9; A. 6. Nuevo Leon, Mexico. (*Girard.*)

(*Limia couchiana* Grd. Proc. Acad. Nat. Sci. Phila. 1859, 116: *Pœcilia couchii* Günther, vi, 347.)

164.—GIRARDINUS Poey.*

(Poey, Mem. Cuba, i, 383, 1851: type *Girardinus metallicus* Poey, from Cuba.)

Body moderately slender; mouth small; mandible very short, its bones not united; snout short; both jaws with a single series of slender, movable, pointed teeth; scales rather large; anal fin more or less in advance of dorsal, in the male modified into an intromittent organ; intestinal canal elongate; mud eating. Very small fishes, the smallest

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* PLATYPŒCILUS Günther.

(Günther, Cat. Fishes Brit. Mus. vi, 350, 1866: type *Platypœcilus maculatus* Günther.)

Small fishes allied to *Girardinus*, but with the origin of the anal fin behind that of the dorsal. Mexico. (*πλατυς*, broad; *ποικιλος*, *Pœcilus=Pœcilia.*)

P. maculatus Gthr.

Body much compressed and elevated. Caudal peduncle short and deep. Olivaceous, a roundish black spot on middle of root of caudal; a black spot on middle of side of body; dorsal often spotted with black; margins of anal and caudal black. Head $3\frac{1}{2}$; depth $2\frac{1}{3}$. D. 10; A. 9; scales 25–8. L. $1\frac{1}{3}$ inches. Mexico. (*Günther.*)

(Günther, vi, 350.)

GOODEA Jordan.

(Jordan, Proc. U. S. Nat. Mus. 1879, 299: type *Goodea atripinnis* Jor.)

Form of *Fundulus*, but with the intestinal canal elongate, the dentary bones loosely joined, and the teeth slender, movable, *tricuspid*, attached in a single series on the outer edge of the jaws, not closely set. Fins small, the dorsal and anal similar, the dorsal slightly in advance of anal. No spines. Scales moderate. Limnophagous. Sexual changes, if any, unknown. Mexico. (Dedicated to G. Brown Goode.)

G. atripinnis Jordan.

Bluish above; sides nearly plain; a silvery streak along each row of scales. Vertical fins chiefly black, especially on the distal half. Body oblong, compressed, the back nearly straight, the caudal peduncle deep. Head short, broad, depressed. Mouth small. Lower jaw projecting. Teeth loosely inserted, not close together. Eye $3\frac{1}{3}$ in head, a little more than half the width of the interorbital space. Humeral scale somewhat enlarged. Fins small. Dorsal slightly in advance of anal. Caudal small. Head 4; depth 4. D. 12; A. 13; Lat. l. 38; L. transv. 13. L. 4 inches. Guanajuato, Mexico. From a salt lake in a volcanic basin.

(Jordan, Proc. U. S. Nat. Mus. 1879, 299.)

vertebrate animals known, found in the fresh waters of the warmer parts of America. (Dedicated to Charles Girard.)

569. G. formosus Grd.

Body short. Snout very short. Anal smaller than dorsal. Brownish olive, with a black streak from the snout along the middle of the side, crossed by 6 or 8 brownish-black vertical streaks; a black spot at bases of caudal, dorsal, and anal. Head $3\frac{1}{2}$; depth $3\frac{3}{4}$. D. 7; A. 9; Lat. l. 28. L. 1 inch. South Carolina to Florida; said to be the smallest known fish.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 62; Günther, vi, 354.)

570. G. occidentalis (B. & G.) Grd.

Brownish above, with a black lateral stripe; a black line along lower margin of tail. Fins unicolor. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. D. 7; A. 7. Gila Basin. (*Girard.*)

(*Heterandria occidentalis* B. & G. Proc. Acad. Nat. Sci. Phil. 1853, 390; Girard, U. S. Mex. Bound. Ichth. 73; Günther, vi, 354: *Girardinus sonoriensis* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 120: *Girardinus sonoriensis* Günther, vi, 355.)

Family L.—UMBRIDÆ.

(*The Mud Minnows.*)

Body oblong; broad anteriorly; compressed behind. Head large, flattened above. Mouth moderate, the maxillary without distinct supplemental bone. Bands of villiform or cardiform teeth on premaxillaries, lower jaw, vomer, and palatines; premaxillaries not protractile. Lateral margin of upper jaw formed by the broad, short maxillaries, which are toothless; lower jaw the longer. Gill-openings wide; the membranes scarcely connected; gill-rakers little developed; branchiostegals 6–8. Scales moderate, cycloid, covering head and body; lateral line obscure or wanting. Dorsal fin moderate, posterior, in advance of anal; ventrals small, close to anal; pectorals inserted low; caudal fin rounded. Stomach without blind sac; no pyloric cœca; pseudobranchiæ hidden, glandular; air-bladder simple; oviparous; sexes similar. Carnivorous fishes living in mud or among weeds at the bottom of clear sluggish streams and ponds, extremely tenacious of life, like the *Cyprinodontidæ*. Genera 2; species 3, *Umbra crameri* of Austria, and the following. The family is very close to the *Esocidæ*, differing mainly in the smaller mouth and weaker teeth.

(*Umbridæ* Günther, vi, 231, 232.)

* Pectorals narrow, with few (12–15) rays; ventral rays 6; scales moderate. UMBRA, 165.
** Pectorals broad, with many (33–36) rays; ventral rays 3; scales small.. DALLIA, 166.

165.—UMBRA Müller.

Mud-fishes.

(*Melanura* Agassiz.)

(Kramer; Müller, Abhandl. Akad. Wiss. Wien, Berl. 1842, 188: type *Umbra crameri* Müller.)

Body oblong, covered with cycloid scales of moderate size, without radiating striæ; no lateral line. Head shortish, little depressed. Eye rather small. Cleft of mouth moderate. Ventral fins 6-rayed, below or slightly in front of dorsal; anal fin much shorter than dorsal. Pectorals rather narrow, rounded, placed low, with 12–15 rays, which are much jointed. Caudal rounded. Preopercle and preorbital with mucous pores. Branchiostegals 6. Gill-rakers short, thick. Size small. Two species, very similar to each other, inhabiting the waters of the United States and Austria. (Latin, *umbra*, a shade.)

571. U. limi (Kirt.) Gthr.—*Mud Minnow; Dog-fish.*

Dark-green or olive, mottled, sides with irregular narrow pale bars, these often obscure or wanting; a distinct black bar at base of caudal; whitish stripes sometimes present along the rows of scales. Head $3\frac{3}{4}$ in length; depth $4\frac{1}{4}$. B. 6; P. 14; D. 14; A. 8; V. 6; Lat. l. 35; L. transv. 15. L. 4 inches. Vermont to Minnesota and South Carolina. Abundant northward in weedy streams and ditches. "A locality which with the water perfectly clear will appear destitute of fish will perhaps yield a number of mud-fish on stirring up the mud at the bottom and drawing a seine through it. Ditches in the prairies of Wisconsin, or mere bog-holes, apparently affording lodgment to nothing beyond tadpoles, may thus be found filled with *Melanuras*." (*Baird.*)

(*Hydrargyra limi* Kirtland, Bost. Journ. Nat. Hist. iii, 277: *Melanura annulata* Ag. Am. Journ. Sci. & Arts, 1854, 135: *Umbra limi* Günther, vi, 232: *Leuciscus pygmæus* De Kay, New York Fauna, Fishes, 214: *Umbra pygmæa* Jordan, Bull. U. S. Nat. Mus. x, 53; the eastern form, *pygmæa*, usually slightly differing in proportions.)

166.—DALLIA Bean.

(Bean, Proc. U. S. Nat. Mus. 1879, 358: type *Dallia pectoralis* Bean.)

Body oblong, covered with small, partly embedded cycloid scales; a trace of lateral line; a line of mucous tubes below eye. Eye small. Cleft of mouth moderate. Villiform or almost cardiform teeth on jaws, vomer, and palatines; those on premaxillaries enlarged. Ventrals in

front of dorsal, composed of 3 rays; base of anal about as long as that of dorsal; caudal fin rounded; pectoral fin rounded, with a somewhat fleshy base, with 33–36 rays. Branchiostegals 7 or 8. Streams of Alaska. (Dedicated to W. H. Dall.)

572. D. pectoralis Bean.

Body dusky brown, mottled with whitish. Belly whitish, often speckled; fins with dark spots. Body rather elongate. Eye small, 6 or 7 in head. Pectoral about half as long as head; ventral one-third; anal beginning opposite front of dorsal and ending nearly opposite its last ray. Scales on belly very small. Head 4; depth 5. D. 12; A. 13; P. 34; V. 3; scales 11–77–11. L. 8 inches. Saint Michael's, Alaska.

(Bean, Proc. U. S. Nat. Mus. 1879, 358.)

Family LI.—ESOCIDÆ.

(*The Pikes.*)

Body elongate, not elevated, more or less compressed. Head long; the snout much prolonged and depressed. Mouth very large; its cleft forming about half the length of the head; lower jaw the longer; upper jaw not protractile, most of its margin formed by the maxillaries, which are quite long and provided with a supplemental bone; premaxillaries, vomer, and palatines with broad bands of strong cardiform teeth which are more or less movable; lower jaw with strong teeth of different sizes; tongue with a band of small teeth. Head naked above; cheeks and opercles more or less scaly; gill-openings very wide; gill-membranes separate, free from the isthmus; gill-rakers tubercle-like, toothed; branchiostegals 12–20. Scales small; lateral line weak, obsolete in young specimens, developed in the adult. Dorsal posterior, opposite and similar to anal; caudal fin emarginate; pectoral fins small, inserted low; ventrals rather posterior; vent normal; no adipose fin; no barbels; stomach not cœcal, without pyloric appendages; pseudobranchiæ glandular, hidden; air-bladder simple. Fishes of moderate or large size, inhabiting the fresh waters of the northern parts of Europe, Asia, and North America. Genus 1; species about 6, one of them cosmopolitan, the rest all confined to America. The species are all noted for their greediness and voracity.

(*Esocidæ* Günther, vii, 226–230.)

167.—ESOX Linnæus.

Pikes.

(Linnæus, Systema Naturæ: type *Esox lucius* L.)

Characters of the genus included above. (Latin, *esox*, a pike; Greek, ἰσοξ; probably from ἰσος, equal; ὀξυς, sharp.)

a. Cheeks as well as opercles entirely scaly; branchiostegals 11–14; color greenish, reticulated. (*Picorellus** Raf.)

b. Branchiostegals normally 12.

573. E. americanus Gmelin.—*Banded Pickerel.*

Body short and robust; head heavy, with blunt short snout, ; eye rather large, about 5 in head, its diameter nearly half the length of the snout, its posterior margin scarcely behind middle of head; upper branchiostegals scaly. Dark green; sides with about twenty distinct, blackish, curved bars, sometimes obscurely marked, but not distinctly reticulated; a black bar below eye, another from upper edge of opercle through eye to snout. Head $3\frac{3}{5}$; depth $5\frac{1}{2}$. B. 12–13; D. 11; A. 11; Lat. l. 105. L. 12 inches. A small pickerel, abundant from Massachusetts to Florida, in streams east of the mountains.

(*Esox lucius, β americanus* Gmelin, Systema Naturæ, 1788, 1390: *Esox niger* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 415: *Esox fasciatus* Dekay, New York Fauna, Fishes, 224: *Esox ornatus* Storer, Fish. Mass. 313: *Esox niger* Günther, vi, 229: *Esox ravenelii* Holbr. Ich. S. C. 1860, 201.)

574. E. salmoneus Raf.—*Little Pickerel.*

Body moderately stout, somewhat compressed; head rather short, longer than in *E. americanus*, but shorter than in *E. reticulatus*, the eye being exactly in the middle of the head; eye large, less than 3 times in snout, about 6 in head; caudal well forked. Color green or grayish; sides with many curved streaks, sometimes forming bars, but more usually forming marmorations or reticulations, the color extremely variable, sometimes quite plain; sides of head usually variegated; a dark bar downward from eye, and one forward; base of caudal sometimes mottled; other fins usually plain. Head $3\frac{1}{2}$; depth 5–6. D. 11; A. 11; Lat. l. 105. L. 12 inches. Mississippi Valley and southeastward, a small species very abundant in the small streams and bayous of the South and West.

(Rafinesque, Ich. Oh. 1820, 70; Jordan, Man. Vert. ed. 2d, 268: *Esox umbrosus* Kirtland, Cleveland Annals of Science, 1854, 79: *Esox umbrosus* Cope, Trans. Am. Phil. Soc. Phila. 1866, 409: *Esox cypho* Cope, Proc. Acad. Nat. Sci. Phila. 1865, 79: *Esox cypho* Günther, vi, 230: *Esox porosus* Cope, Trans. Am. Phil. Soc. Phila. 1866, 408. This form (*cypho* = *porosus*), distinguished mainly by the arched back and steep profile, is probably a variety or accidental form of the preceding.)

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* Rafinesque, Ich. Oh. 1820, 70: type *Esox vittatus* Raf. (A latinization of *pickerel.*)

bb. Branchiostegals 14–16.

575. E. reticulatus Le Sueur.—*Common Eastern Pickerel; Green Pike.*

Body rather slender, deepest near the middle and tapering backward to a slender caudal peduncle; head long, the snout prolonged, so that it is not much shorter than the rest of the head; eye small, about 3½ in snout, 8 in head; caudal well forked. Color green of varying shades, sides with golden lustre, and marked with numerous dark lines and streaks, which are mostly horizontal, and by their junction with one another produce a reticulated appearance; a dark band below eye; fins plain. Head 3½; depth 6. B. 15; D. 14; A. 13 (counting developed rays only as in other cases); Lat. l. 125. L. 24 inches. Maine to Alabama, everywhere east of the mountains, not found west of the Alleghanies.

(Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 440, 1818; Günther, vi, 229; Storer, Fish. Mass. 311, and of all authors: *Esox affinis* Holbrook, Ich. S. Car. 1860, 198: *Esox phalcratus* Say, Journ. Acad. Nat. Sci. Phila. i, 416.)

aa. Cheeks scaly; lower half of opercles bare; branchiostegals 14–16; species light-spotted on a darker ground. (*Esox.*)

576. E. lucius L.—*Pike.*

Body moderately elongate, the back little elevated; head rather long, the eye exactly midway in its length. General color bluish, or greenish gray, with many whitish spots which are usually smaller than the eye and arranged somewhat in rows; dorsal, anal, and caudal fins with roundish black spots; young with the white spots coalescing, forming oblique cross bars; a white horizontal band bounding the naked part of the operculum. Head 3⅔; depth 5; eye 6⅓ in head. B. 15, in the American var. *estor* (13 or 14 in European specimens); D. 17; A. 14; Lat. l. 123. L. 2–4 feet. Fresh waters of the northern parts of Europe, Asia, and North America; in the Eastern United States south to Northern Ohio; very abundant.

(*Esox lucius* L. Syst. Nat.; Günther, vi, 226, and of authors generally: *Esox estor* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 413, 1818: *Esox estor* Günther, vi, 228: *Esox deprandus* Günther, vi, 229: *Esox boreus* Agassiz, L. Superior, 317.)

aaa. Lower half of cheeks as well as of opercles bare; branchiostegals 17–19; black-spotted on a lighter ground. (*Mascalongus** Jordan.)

577. E. nobilior Thompson.—*Muskallunge.*

General form of *E. lucius*, the head a little larger proportionally; scaly part of cheeks about as wide as eye; the scales on both cheeks

* Jordan, Rept. Ohio Fish. Com., 1877, 92: type *Esox nobilior* Thompson. (Latin, *masca*, mask; *longus*, long.)

and opercles in about 8 rows. Color dark gray; sides with round blackish spots on a ground color of grayish silvery; belly white; fins spotted with black. Head $3\frac{2}{3}$; depth 6. B. 18; D. 17; A. 15; Lat. l. 150. L. 4 to 8 feet. A magnificent fish, by far the largest of its family, found in the Great Lake region and northward.

(*Esox estor* Dekay, N. Y. Fauna, Fishes, 222, and of various authors, not of Le Sueur; Thompson, Proc. Bost. Soc. Nat. Hist. 1850, iii, 163; Jordan, Bull. U. S. Nat. Mus. x, 54, and of most late writers.)

ORDER O.—APODES.*

(*The Eels.*)

Scapular arch free behind the cranium; no præcoracoid arch. Air-bladder, if present, with a pneumatic duct. Ventral fins wanting. Maxillary and premaxillary more or less connate with other bones or with each other, sometimes entirely wanting. Pharyngeal and opercular apparatus often deficient. Vertebræ in increased number. Vertical fins without spines, usually confluent around the tail. Gill-openings usually narrow, separated by a broad isthmus, sometimes close together or confluent. No pseudobranchiæ. Body eel-shaped; naked, or with rudimentary scales.

As here understood, this order includes most of the old order of *Apodes*, excluding as separate orders the *Glanencheli* (*Gymnotidæ*) and the *Ichthyocephali* (*Monopteridæ*). It thus includes the *Holostomi*, *Enchelycephali*, and *Colocephali* of Cope, which may be united provisionally until the osteology of various aberrant forms is made known. (*a*, privative; *πούς*, foot.)

(*Symbranchidæ* and *Murænidæ* Günther, viii, 12–145.)

ANALYSIS OF FAMILIES OF APODES.

* Vent much behind head; jaws not greatly produced; dorsal without spines.
† Muscular and osseous systems well developed.
a. Preopercle wanting; lower pharyngeals wanting; gill-openings very small. MURÆNIDÆ, 52.
aa. Preopercle present; lower pharyngeals present.
b. Gill-openings well separated ..... ANGUILLIDÆ, 53.
bb. Gill-openings contiguous; mouth very large, with small, sharp teeth. SYNAPHOBRANCHIDÆ, 54.
†† Muscular and osseous systems feebly developed; gape very wide; stomach extremely distensible ..... SACCOPHARYNGIDÆ, 55.
** Vent under the pectorals; both jaws produced into a very slender beak; body extremely slender; middle of dorsal with spines ..... NEMICHTHYIDÆ, 56.

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* Called *Enchelycephali* in the analytical table on page 81

Family LII.—MURÆNIDÆ.

(*The Murænas.*)

Body elongate, eel-shaped, naked. Head subconical, elevated at the occiput, the snout rather slender; skull less developed than in fishes generally, the opercular bones rudimentary, the preoperculum generally wanting. Premaxillary rudimentary or wanting. Ethmoid very wide. Maxillary, symplectic, pterygoid, basal-branchihyal, superior and inferior pharyngeal bones all wanting, except the fourth superior pharyngeal, which is jaw-like, and supported by a strong superior branchihyal. Teeth various. Gill-opening reduced to a small slit or foramen. Ventral fins none. Pectorals usually wanting; dorsal and anal low, confluent around the tail, sometimes wanting. Skeleton well ossified. Muscular system well developed. Genera 5 or 6; species about 110. Abundant in warm seas, often reaching a large size.

(*Murænidæ engyschistæ* Günther, viii, 93–136: order *Colocephali* Cope, Trans. Amer. Phil. Soc. 1870, 456.)

a. Pectorals none; vertical fins well developed; nostrils round; teeth all acute.
MURÆNA, 168.

168.—MURÆNA Linnæus.

(Artedi; Linn. Syst. Nat.: type *Muræna helenæ* L.)

Pectoral fins none; dorsal and anal fins well developed. Posterior nostril round, with or without tube; anterior nostril with a tube. Teeth well developed, acute. Tongue not free. No lateral line. Body usually moderately elongate. Species very numerous in warm seas. (*μύραινα*, the ancient name of *Muræna helenæ;* from *μύρον*, a sweet oil.)

a. Posterior as well as anterior nostrils tubular. (*Muræna.*)

578. M. melanotis (Kaup) Gthr.—*Moray.*

Brownish black, everywhere with numerous round yellowish spots, most of which are smaller than the eye, these sometimes confined to the head and trunk; a large round black spot around the gill-opening; angle of mouth black. Nasal tubes subequal in length, shorter than the eye. Maxillary teeth biserial, and in young examples mandibulary teeth also. Canine teeth somewhat knife-shaped, of moderate length. Mouth capable of being completely shut. Gill-opening narrow, not wider than the small eye. Snout of moderate length. Cleft of mouth of moderate length, about $2\frac{1}{2}$ in length of head. Tail longer than body. Head $2\frac{1}{2}$ in length of trunk. West Indies, &c. (*Günther.*) Specimens

probably belonging to this species lately obtained at Charleston, S. C., by Mr. R. E. Earll.

(*Limamuræna melanotis* Kaup, Aale Hamburg Mus. 27; Günther, viii, 98.)

aa. Posterior nostril without tube. (*Gymnothorax** Bloch & Schneider.)

579. M. mordax Ayres.—*Conger Eel.*

Dark brown, vaguely reticulated with narrow, paler markings and spots; a round dark blotch about gill-opening; lower side of head and throat with about 15 dark lengthwise streaks; belly with similar streaks running crosswise; a dark line on each side of base of anal, with short cross-branches. Snout short, narrow, and pointed. Occipital region becoming fleshy and much elevated with age. Tail forming about half the total length. Head 7 in length. Tube of anterior nostril half as long as the eye; posterior nostril with a slight border. Eye above the middle of the gape, $2\frac{1}{4}$ in snout, which is $6\frac{1}{2}$ in rest of head. Gill-opening slightly larger than eye. Sides of upper jaw with two series of teeth posteriorly, the outer series of small, close-set, recurved, triangular teeth, which are immovable; inner teeth about 5, similar, but larger, depressible; a groove between the two series; in front of these, continuous with the outer series, are 3 fixed, knife-shaped teeth, then a movable tooth, then 3 fixed teeth; on the middle line of vomer 3 depressible fangs, the posterior the largest of the teeth; in the lower jaw a single series, corresponding to the outer series in the upper jaw, some of the front teeth enlarged and fixed. Reaches a length of 5 feet. Point Concepcion to Cape San Lucas; abundant about the islands, and remarkable for its ferocity.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 30.)

580. M. ocellata (Agassiz) Jenyns.

Teeth uniserial, some of them slightly serrated. Mandible with 12–14 teeth on each side, the two anterior being canines of moderate size; "intermaxillary" teeth not much larger than "maxillary"; there are no teeth on the mesial line between the "intermaxillary" teeth. The mouth can be shut completely. Anterior nasal tubes short. Snout short, thick. Eye rather small. Cleft of the mouth of moderate width, extending beyond eye. Tail longer than the body. Head about half as long as trunk. Brownish, with numerous, small round white spots irregularly disposed, the largest about as large as the eye. Dorsal fin

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* Bloch & Schneider, Syst. Ichth. 525, 528; originally equivalent to *Muræna*. (γύμνος, naked; θωραξ, chest; in allusion to the absence of pectorals.)

with subalternate large white and black spots; anal (and dorsal) with a broad black margin. (*Günther.*) Florida and Texas southward.

(*Gymnothorax ocellatus* Agassiz, Spix Pisc. Brasil, 91; Günther, viii, 102: *Neomuræna nigromarginata* Girard, U. S. Mex. Bound. Surv. Ichth. 76.)

FAMILY LIII.—ANGUILLIDÆ.

(*The True Eels.*)

Body elongate, serpentiform, naked or covered with imbedded scales. Head conical, the snout not much produced, sometimes very blunt. Preoperculum present. Premaxillaries present, separated on the median line by the ethmoid. Maxillaries wanting or connate with the premaxillary, which forms the border of the mouth. Superior branchihyals and inferior and superior pharyngeals well developed, the latter of three bones. Teeth various. Gill-openings separate, not very small (except in *Simenchelys*). Ventral fins none; dorsal and anal low, usually confluent around the tail; pectorals generally present, placed rather high. Vent not far from anal fin. Skeleton ossified. Muscular system well developed. Heart not far behind gills. As here understood, this family includes a wide variety of forms, which have been often arranged in several families. It is probable that some division will be found necessary, but we have not the data on which to make it. Genera about 20; species about 160. In all warm seas, many of them ascending rivers.

(*Anguillidæ*, part; Gthr. viii, 23–90.)

a. Tongue not free anteriorly.
  b. End of tail not surrounded by the fin; nostrils labial. (*Ophisurinæ.*)
    c. Pectoral fins wanting (rarely rudimentary); teeth small, conical. CŒCULA, 169.
    cc. Pectoral fins present; teeth acute ..... OPHICHTHYS, 170.
  bb. End of tail surrounded by the fin.
    d. Nostrils labial. (*Myrinæ.*)
      e. Teeth granular ..... MYRICHTHYS, 171.
    dd. Nostrils superior or lateral. (*Muræneosocinæ.*)
      f. Pectoral fins present; dorsal and anal rudimentary .... NEOCONGER, 172.
aa. Tongue free anteriorly; pectorals present; nostrils not labial.
  g. Snout subconical.
    h. Body scaleless. (*Congrinæ.*)
      i. Jaws with an outer series of close-set teeth; lower jaw not projecting ..... CONGER, 173.
    hh. Body with rudimentary, linear, imbedded scales, arranged at right angles with each other. (*Anguillinæ.*)
      j. Teeth in bands; lower jaw projecting ..... ANGUILLA, 174.
  gg. Snout very short and blunt; body scaly; mandible very strong. (*Simenchelyinæ.*)
    k. Teeth blunt, incisor-like in one series; gill-opening a very short longitudinal slit ..... SIMENCHELYS, 175.

169.—CŒCULA Vahl.

(*Sphagebranchus* Bloch & Schneider.)

(Vahl, Skrivt. Naturh. Selsk. iii, 1794, 149: type *Cœcula pterygera* Vahl=? *Dalophis polyophthalmus* Bleeker.)

Body extremely slender. Teeth equal, small, conical, on jaws and vomer. Nostrils labial. Tongue not free at tip. Pectoral fins wanting or rudimentary; dorsal fin present. Extremity of tail free. Gill-openings small, separated by a narrow isthmus. Eyes small. (Latin, *cæcus*, blind.)

581. C. scuticaris (Goode & Bean) J. & G.

Brownish, paler below. Teeth small, conical, in two series on jaws and vomer. Gill-openings close together. Dorsal fin beginning far in advance of the gill-opening, a little nearer the tip of the snout than the gill-opening, at a distance from the former equal to three times the length of the snout. Head 8½ in distance from gill-opening to vent, and 8 in tail. Snout pointed, 6 in head. Pectorals extremely small, their length less than $\frac{1}{300}$ the total length. (*Goode & Bean.*)

(*Sphagebranchus scuticaris* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 344.)

170.—OPHICHTHYS Ahl.

(*Ophisurus* Lacépède.)

(Ahl, Specim. Ichth. 1789, 9.)

Body elongate, naked. Teeth all pointed; vomerine teeth present. Nostrils labial. Tongue not free at tip. Dorsal and anal fins present; pectoral fins developed. End of tail not surrounded by the fin. Species very numerous, found in all warm seas. (*οφις*, snake; *ιχθυς*, fish.)

* Canine teeth very distinct. (*Mystriophis** Kaup.)
† Teeth in each jaw in a double series.

582. O. punctifer (Kaup) Günther.

Snout narrowed, short, spoon-shaped, twice as long as the eye. Cleft of the mouth very wide. Teeth pointed, fixed, unequal in size, those of the premaxillary in a single arched series, the foremost being the longest of all the teeth; outer series of teeth in jaws with canines; vomerine teeth triserial, rather small. Lips not fringed. Gill-openings wide. Origin of the dorsal fin at some distance behind the pectoral, which is well developed. Tail somewhat longer than the body.

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* Kaup, Apodes, 1856, 10: type *Ophisurus rostellatus* Rich. (*μυστρον*, spoon; *οφις*, snake; from the form of the snout.)

Brownish, with numerous small roundish black spots. (*Günther.*)
West Indies, north to West Florida.

(*Crotalopsis punctifer* Kaup, Abhandl. Naturwiss. Verein Hamburg, iv, 2, 1860: *Macrodonophis mordax* Poey, Rept. Fis.-Nat. Cuba, ii, 252, 1868: *Crotalopsis mordax* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 154; Günther, viii, 56.)

** No distinct canine teeth; snout moderate. (*Murænopsis** Le Sueur.)

‡ Teeth in the lower jaw in a double series; cleft of mouth wide.

583. O. triserialis (Kaup) Günther.

Body with larger and smaller roundish black spots, alternating; head with many small black spots above and below; belly plain; head and body with longitudinal streaks. Gill-openings curved, well separated, a little longer than pectorals. Head with longitudinal wrinkles, its length two-fifths the distance from the gill-opening to the vent. Mouth wide, its cleft more than one-third the head. Eye moderate, $1\frac{2}{3}$ in snout. Teeth pointed, fixed, all biserial, except those on vomer, which are uniserial. Pectoral fin $3\frac{1}{2}$ in head, the dorsal beginning above its terminal portion. Tail rather longer than body. Southern California to Brazil. (Described from Garrett's type of *O. californiensis.*)

(*Murænopsis triserialis* Kaup, Apodes, 1856, 12; Günther, viii, 58: *Ophisurus californiensis* Garrett, Proc. Cal. Acad. Nat. Sci. iii, 66.)

‡‡ Teeth in lower jaw in one series. (*Herpetoichthys* Kaup.)

584. O. ocellatus (Le S.) Günther.

A series of round white spots along the middle of the side of the body and tail; dorsal fin with a black edge; some white dots on the back behind the head and a white line across the occiput. Length of the head rather less than one-third of the distance of the gill-opening from the vent. Snout pointed, the upper jaw projecting beyond the lower. Cleft of the mouth wide, two-fifths the length of the head. Eye of moderate size, two-thirds of the length of the snout, and situated in the anterior third of the head. Teeth pointed, fixed, unequal in size; the intermaxillary teeth largest, arranged in a curved, transverse series; maxillary teeth in a double, vomerine and mandibulary teeth in a single series; only the anterior mandibulary teeth form a short, double series. Length of the pectoral fin rather more than one-third that of the head; dorsal fin commencing opposite the posterior third of the pectoral. Tail longer than the body. (*Günther.*)
West Indies, north to West Florida.

(*Murænopsis ocellatus* Le Sueur, Journ. Acad. Nat. Sci. Phila. v, 108; Günther, viii, 68: *Herpetoichthys ocellatus* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 155.)

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* Le Sueur, Journ. Acad. Nat. Sci. Phila. v, 108: type *Murænopsis ocellata* Le S. (*μύραινα, Muræna; οψις*, appearance.)

171.—MYRICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 58: type *Myrichthys tigrinus* Grd.)

Pectorals present; dorsal inserted in advance of base of pectorals, at a point nearer to them than to the eye. Head large; the lower jaw shorter than the upper. Teeth granular, disposed in elongated patches on the jaws, palatines, and nasal bones. Eyes well developed. Gill-openings lateral, moderate. Body naked. Nostrils near the end of the snout, the upper very small, opposite the lower, which are conspicuous and tubular. (μυρος, Myrus, an ancient name of *Muræna*; ἰχθύς, fish.)

585. M. tigrinus Grd.

Brownish above, throat and belly dull whitish; roundish, dark brown spots on the body in four longitudinal series; belly plain; throat with whitish spots; spots on head smaller and deeper in color. Fins olivaceous; pectoral and anal plain; dorsal spotted like the body, white-edged. Body subcylindrical, somewhat compressed, tapering backward. Pectorals broader than long. Head 12 in length. Cleft of mouth extending beyond eyes. Teeth unequal, in many series; three series on the front of the dentary bones; two on the upper jaw and two on the shaft of the vomer. Length 2 feet. (*Girard.*) Adair Bay, Oregon, not found by recent collectors.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 58.)

172.—NEOCONGER Girard.

(Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 77: type *Neoconger mucronatus* Grd.)

Scaleless. Pectoral fins present: dorsal and anal fins rudimentary, passing around the tail, towards the end of which they are more developed. Cleft of the mouth extending beyond the small eye; maxillary teeth slender, in several series; vomerine teeth uniserial, forming a patch in front; posterior nostrils near the anterior rim of the orbit, anterior near the tip of the snout; tail not much longer than the body. Gill-openings vertical, rather large. Gulf of Mexico. (νέος, new; κόγγρος, Conger.)

586. N. mucronatus Grd.

Dark reddish brown above, paler below; head small, slender, pointed; upper jaw the longer; dorsal fin beginning just in front of the vent, forming a membranous ridge uutil near the tail, where it expands and becomes fin-like; pectorals small. Coast of Texas. (*Girard.*)

(Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 77; Günther, viii, 49.)

173.—ANGUILLA Thunberg.

Eels.

(Thunberg, Nouv. Mém. Stockh. about 1791: type *Muræna anguilla* L.)

Body elongate, compressed behind, covered with imbedded scales, which are linear in form, and placed obliquely, some of them at right angles to others. Lateral line well developed. Head long conical, moderately pointed, the rather small eye well forward and over the angle of the mouth. Teeth small, subequal, in bands on each jaw and a long patch on the vomer. Tongue free at tip. Lips rather full, with a free margin behind, attached by a frenum in front. Lower jaw projecting. Gill-openings rather small, slit-like, about as wide as base of pectorals and partly below them. Nostrils superior, well separated, the anterior with a slight tube. Vent close in front of anal. Dorsal inserted at some distance from the head, confluent with the anal around the tail. Pectorals well developed. Species numerous, in most warm seas, ascending streams, but mostly spawning in the sea. (Latin, *anguilla*, an eel.)

587. A. rostrata* (Le Sueur) Dekay.—*Common Eel.*

Brown, nearly plain, often tinged with yellowish; paler below. Distance from snout to dorsal about one-third the length. Distance between anal and front of dorsal about equal to the length of the head. Head $8\frac{1}{4}$ in length, $2\frac{1}{2}$ in distance from gills to vent. Pectoral shorter than mandible. L. 50 inches. Atlantic coast of the United States; very abundant from Maine to Mexico; ascending all streams and resident throughout the Mississippi Valley. Also recorded from China.

(*Muræna rostrata* and *bostoniensis* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 81: *Anguilla bostoniensis* Günther, vii, 31. Var. ? *texana* Kaup, from the Gulf of Mexico is characterized by its thicker lips: *Anguilla texana* Kaup, Apodal Fish. 45: *Anguilla tyrannus* Grd. U. S. Mex. Bound. Surv. Ichth. 75.)

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* Another species has been accredited to our coast, viz:

A. vulgaris Raf.—European Eel. Distance from snout to dorsal $3\frac{2}{5}$ in length. Distance from front of anal to front of dorsal, about a third longer than the head. Head $9\frac{1}{4}$ in length. Pectoral about as long as the mandible. Vertebræ 45+70. Coasts of Europe, perhaps straying to our coasts. "I have examined an example from New Jersey; it is in the Liverpool Museum (*Günther*)."

(*Muræna anguilla* L. Syst. Nat.; Rafinesque, Indice d'Ittiol. Sicil. 1810, 37; Turton, Brit. Fauna, 87; Günther, viii, 28: *Anguilla acutirostris* Risso, Eur. Mérid. iii, 198.)

174.—CONGER* Cuvier.

Conger Eels.

(Cuvier, Regne Anim. II, 1817: type *Muræna conger* Linn, etc.)

Body formed as in *Anguilla*, the skin scaleless. Head depressed above, anteriorly pointed. Lateral line present. Mouth wide, its cleft extending at least to below the middle of the eye. Teeth in the outer series in each jaw equal and close-set, forming a cutting-edge. No canines. Band of vomerine teeth short. Tongue anteriorly free. Vertical fins well developed, confluent around the tail; pectoral fins well developed; dorsal beginning close behind pectorals. Gill-openings rather large, low. Eyes well developed. Posterior nostril near eye; anterior near the tip of the snout, with a short tube. Lower jaw not projecting. Skeleton different in numerous respects from that of *Anguilla*. Vertebræ about 56 + 100. In most warm seas.

The name *Leptocephalus* was first given to a peculiar band-shaped, pellucid, worm-like animal, the type of a considerable group of fishes, the *Leptocephalidæ* or *Helmichthyidæ*, which has been made to constitute a distinct order, *Lemniscati*. It has, however, been satisfactorily shown by Carus, Gill, Günther, and others, that these singular forms are not distinct species, but are early stages in the development of other fishes, *Leptocephalus morrisii*, of *Conger niger*, and the others of various Anguilloid, Stomiatoid, and Clupeoid forms. (See Günther, viii, 136.) It is thought by Dr. Günther that the Leptocephalid forms are probably "individuals arrested in the development at a very early period of their life, yet continuing to grow to a certain size, without corresponding development of their internal organs, and perishing without having attained the characters of the perfect animal." (κόγγρος, Conger, the ancient name of the Conger Eel.)

588. C. niger (Risso) J. & G.—*Conger Eel.*

Dark brown above, lower parts soiled white; dorsal and anal pale, with a black margin (sometimes uniform black); pectorals dusky, edged with paler; pores of lateral line whitish. Dorsal inserted over the posterior margin of the pectoral, or slightly behind it; pectoral one-third

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*The prior name *Leptocephalus* (Gmelin, Syst. Nat. i, 1150, 1788: type *Leptocephalus morrisi* Gmel., an arrested larval form of *Conger*) should, in strictness, supersede *Conger*. The use of the term for the adult normal fish would, however, lead to confusion, as *Leptocephalus* has for nearly a hundred years been applied to various singular organisms, lately shown to be undeveloped forms of eels and of certain *Isospondyli*.

as long as the head. Teeth in a single series on the sides of the jaw, in a broad patch at the tip. Cleft of mouth extending to beyond the middle of the rather large eye. Jaws equal or the lower included. Distance from snout to vent three times the length of the head. Head $7\frac{1}{3}$. L. 50 inches. Europe, to South America and East Indies, frequently taken on our Atlantic coast. We are unable to detect any difference between American and European examples. It sometimes reaches a length of 8 feet.

(*Anguilla conger* L. Syst. Nat.: *Muræna nigra* Risso, Ichth. Nice, 1810, 93: *Conger vulgaris* Cuvier, Règne Anim. 1817: *Anguilla oceanica* Mitchill, Journ. Acad. Nat. Sci. i, 407: *Conger occidentalis* Dekay, N. Y. Fauna, Fishes, 314, 1842: *Conger vulgaris* Günther, viii, 38: *Conger oceanicus* Gill, Rept. Com. Fisheries for 1871–'72, 811.)

175.—SIMENCHELYS Gill.

Pug-nosed Eels.

(Gill MS.; Goode & Bean, Bull. Essex Inst. xi, 1879, 27: type *Simenchelys parasiticus* Gill.)

Body eel-shaped, covered with linear imbedded scales, disposed at right angles as in *Anguilla*. Lateral line present, faint. Head very short, rounded, very blunt anteriorly, slightly compressed. Mouth small, entirely anterior. Premaxillaries and maxillaries of each side side coalesced and separated from those of the other side by the ethmoid. Jaws equal, their edges hard, provided with a single series of small, rounded, close-set, incisor-like teeth. No vomerine teeth. Tongue broad, somewhat free anteriorly. Mandible very deep and strong. Operculum sabre-shaped. Gill-openings very small, inferior, longitudinal, well separated, situated in front of the pectorals and below them. Both nostrils large, the anterior with a slight rim, but no tube. Lips full. Pectorals short; vertical fins confluent around the tail, the dorsal beginning not far behind pectorals; vent in front of anal, near middle of body. One species known, probably the type of a distinct family. (σιμος, pug-nosed; ἔγχελυς, eel.)

589. S. parasiticus Gill.

Dark brown, nearly plain. Eye rather large, anterior, but behind the angle of the mouth, scarcely shorter than the snout. Head $\frac{1}{5}$ length of trunk; about $\frac{1}{2}$ distance from snout to origin of dorsal; width of gill slit equaling diameter of orbit; interorbital space nearly half length of head. Vent not much in advance of middle of body. Dorsal beginning just behind tips of pectorals; fins rather low. Off-shore banks, south of Newfoundland; abundant. Individuals have been found burrowing in the flesh of the halibut.

(Gill, MS. in Goode & Bean, Bull. Essex Inst. xi, 27, 1878.)

Family LIV.—SYNAPHOBRANCHIDÆ.

(*The Synaphobranchoid Eels.*)

Body eel-shaped, covered with linear, imbedded scales placed at right angles, as in *Anguilla*. Lateral line present. Head long and pointed, the snout produced. Mouth very long, the eye being over the middle of its cleft. Jaws about equal; teeth small, sharp, in a broad band in each jaw, becoming a single series anteriorly; those of inner series in upper jaw and of outer series in mandible somewhat enlarged; vomerine teeth in a narrow band anteriorly. Gill-openings inferior, horizontal, close together, convergent forward, somewhat confluent at the surface, but separated by a considerable isthmus within. Tongue long, free only at the sides. Nostrils large, the anterior with a short tube, the posterior before the lower part of the eye. Pectoral well developed; dorsal low, beginning behind vent; anal longer than dorsal, rather high, its rays slender, branched, not imbedded in the skin; vertical fins confluent around the tail. Vent near the anterior fourth of body. Muscular and osseous systems well developed. Stomach very distensible. Deep-sea fishes; a single genus with 4 species known.

(*Muræniдæ*, group *Synaphobranchina* Günther, viii, 22–23.)

176.—SYNAPHOBRANCHUS Johnson.

(Johnson, Proc. Zoöl. Soc. London, 1862, 169: type *Synaphobranchus kaupii* Johnson = *Muræna pinnata* Gronow.)

Characters of the genus included above. (συνᾱψής, joined; βραγχος, gills.)

590. S. pinnatus (Gronow) Günther.

Uniform brown, rather darker below; the vertical fins darker behind, light-edged anteriorly; inside of mouth blue-black; gill-openings dark. Jaws subequal in length, sometimes the lower, sometimes the upper the longer; the upper with a projecting fleshy tip; maxillary reaching to opposite gill-openings, which are rather longer than the large eye. Head $3\frac{1}{3}$ in distance from snout to dorsal, $2\frac{3}{4}$ in distance to anal, $8\frac{2}{3}$ in length. Eye broader than interorbital space, rather nearer tip of snout than end of maxillary. Pectoral slender, longer than snout. Newfoundland to Madeira, "a common resident of the deep waters of the off-shore banks in 200 to 300 fathoms, where individuals are often taken on the fishermen's trawl lines."

(*Muræna pinnata* Gronow, Syst. Ich. ed. Gray, 1854, 19; Günther, viii, 22; Goode & Bean, Bull. Essex Inst. xi, 1879, 26.)

Family LV.—SACCOPHARYNGIDÆ.

(*The Gulpers.*)

Muscular system very feebly developed, with the bones very thin, soft, and wanting in inorganic matter, connected by a lax, easily torn fibrous tissue. Head and gape enormous. Snout very short, pointed, flexible, like an appendage overlapping the gape. Eye small. Maxillary and mandibulary bones very thin, slender, arched, armed with one or two series of long, slender, curved, widely-set teeth, their points being directed inwards; palate toothless. Gill-openings wide, at some distance from the head, at the lower part of the sides; gills very narrow, free, and exposed. Trunk of moderate length. Stomach distensible in an extraordinary degree. Vent at the end of the trunk. Tail band-like, exceedingly long, tapering into a very fine filament. Pectoral present, small. Dorsal and anal fins rudimentary, the former smaller than the latter, and indicated by a groove bordered by a whitish line on each side, and commencing at a short distance behind the head; a short fine ray occasionally visible towards the end of the trunk. Anal rays distinct, commencing behind the vent, and visible for some distance. One species known, from the North Atlantic.

(*Muræniдæ*, group *Saccopharyngina* Günther, viii, 22.)

177.—SACCOPHARYNX Mitchill.

(Mitchill, Ann. Lyc. Nat. Hist. N. Y. i, 1824, 82: type *Saccopharynx flagellum* Mitch.)

Characters of the genus included above. (Latin, *saccus*, sack; *pharynx*, pharynx.)

591. S. flagellum Mitch.

Uniform deep black. Three specimens have been found floating in the North Atlantic, with their stomachs much distended, they having swallowed some other fish, the weight of which many times exceeded their own. (*Günther.*)

(Mitchill, Ann. Lyc. Nat. Hist. N. Y. i, 1824, 82; Günther, viii, 22: *Ophiognathus ampullaceus* Harwood, Phil. Trans. 1827, 277.)

Family LVI (*a*).—NEMICHTHYIDÆ.

(*The Snipe-Eels.*)

Body excessively slender, not strongly compressed, deepest near the middle, tapering backward to the long and very slender filament-like tail, and forward to a very long and slender neck, which is abruptly

enlarged at the occipital region. No scales. Lateral line obsolete. Head resembling that of *Belone*, the head proper small, short, and rather broad, with flat top and vertical sides. Nostrils large close together in front of the eye, without tube or flap. Jaws excessively prolonged, almost needle-like, the upper the longer and somewhat recurved. Teeth in both jaws small, very numerous, close-set, retrorse. Gill-openings rather large, running downward and forward, separated by a narrow isthmus. Pectorals well developed. Vent close behind pectorals, the abdominal cavity extending far behind it. Anal fin beginning near the vent, higher than the dorsal, becoming obsolete on the caudal filament. Dorsal beginning close behind occiput, its anterior rays soft, succeeded by a long series of very low spines, which are slightly connected by membrane, their height rather less than the length of the interspaces; on the tail, the spines again give place to soft rays. The soft rays of the fins are connected by thin membrane instead of being imbedded in thick skin, as in eels generally. Color translucent, the lower parts dark, the back pale. Stomach not distensible. Muscular and osseous systems well developed. Abdominal cavity extending far behind the vent. One genus known, with three species; singular inhabitants of the deep seas. The position of this family among the *Apodes* is perhaps open to question. A second genus, *Cyema* Gthr., with shorter, soft body, posterior vent, and shorter vertical fins surrounding the tail, perhaps belongs to this family.

(*Muræniдæ*, group *Nemichthyina* Günther, viii, 21.)

178.—NEMICHTHYS Richardson.

(*Leptorhynchus* Lowe: *Belonopsis* Brandt.)

(Richardson, Voyage Samarang, 1848, 10: type *Nemichthys scolopaceus* Rich.)

Characters of the genus included above. (νῆμα, thread; ἰχθύς, fish.)

592. N. scolopaceus Rich.

Head comparatively stout, its depth one-seventh its greatest length. Eye moderate, less than one-third the length of the head without snout. Length of pectoral fins slightly less than height of the anal, which is less than the height of the body and rather more than the greatest depth of the head. Pale above, belly and anal fin blackish, the color not abruptly changing, the back somewhat speckled. L. 36 inches. Atlantic Ocean, in deep water; many specimens lately taken with the beam-trawl off the New England coast.

(Richardson, Voyage Samarang, 10; Günther, viii, 21: *Leptorhynchus leuchtenbergi* Lowe = *Belonopsis leuchtenbergi* Brandt, Mém. Ac. St. Petersb. Sav. Étrang. 1854, 171–174.)

593. N. avocetta Jordan & Gilbert.

Head slenderer, its depth one-ninth its greatest length. Eye large, one-third the head, without snout. Length of pectoral scarcely greater than height of anal, which is scarcely less than the greatest depth of the body, and more than the greatest depth of the head. Translucent; belly with close-set dark spots, its lower edge and anal fin black, the back abruptly white and unspotted. L. 22 inches. Head 10; depth 58; depth of anal 64 in length of body. Puget's Sound; one example known, differing in some slight respects from all Atlantic specimens examined.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 409.)

Sub-class PHYSOCLISTI.

(*The Physoclistous Fishes.*)

Air-bladder, if present, without pneumatic duct, in the adult. Parietal bones separated by the supraoccipital. Ventral fins usually thoracic or jugular, normally with 1 spine and 5 soft rays. Pectoral fin normally inserted high, with vertical base. Vertical fins usually with spines. Premaxillaries normally forming the entire border of the upper jaw. Tail homocercal. (φυσός, bladder; κλείστὸς, closed.)

ANALYSIS OF THE ORDER OF PHYSOCLISTI.

a. Scapula suspended to the anterior vertebræ; maxillary distinct; superior branchihyals and pharyngeals present; inferior pharyngeals not united; no interclavicles; body elongate; ventral fins abdominal or wanting. ..... Opisthomi, P.

aa. Scapula suspended to the cranium by a post-temporal.

b. Lower pharyngeals co-ossified; fins without spines; ventral fins abdominal; third and fourth superior pharyngeals much enlarged. ..... Synentognathi, Q.

bb. Lower pharyngeals separate (or if united, fins with spines and ventrals thoracic).

c. Gills tufted; superior branchihyals and pharyngeals and basal branchihyals wanting; ventrals, if present, abdominal ..... Lophobranchii, R.

cc. Gills pectinate.

d. Superior branchihyals and pharyngeals reduced in number; ventrals abdominal ..... Hemibranchii, S.

dd. Superior branchihyals and pharyngeals normally developed; ventrals mostly thoracic or jugular.

e. Bones of the jaws not united.

f. Pectoral fins not pediculate, the gill-openings in front of them.

g. Cranium normal ..... Acanthopteri, T.

gg. Cranium anteriorly twisted; both eyes on the same side of the head. ..... Heterosomata, U.

ff. Pectoral fins pediculate, their basal bones reduced in number and elongate; gill-openings in the axils ..... Pediculati, V.

ee. Bones of the jaws co-ossified; the dentary with the articular, and the premaxillaries with the maxillaries ..... Plectognathi, W.

Order P.—OPISTHOMI.

(*The Spiny Eels.*)

Scapular arch suspended to the anterior vertebræ. Superior pharyngeals and branchihyals ossified, the third pharyngeal a little larger, the fourth small. Three basal branchihyals; inferior pharyngeals distinct; maxillary bone distinct; supraoccipital separating parietals; no interclavicles; symplectic present; præcoracoid wanting; parietals separated by the supraoccipital; air-bladder, if present, without pneumatic duct; dorsal with spines; ventrals, if present, abdominal. The fishes of this order differ from other *Physoclisti* and agree with the Eels in having the scapular arch free from the cranium and attached to the anterior vertebræ. Two families are known. (ὄπίσθη, backward; ὠμος, shoulder.)

ANALYSIS OF FAMILIES OF OPISTHOMI.

a. Ventral fins wanting; dorsal fin with the soft portion well developed.
MASTACEMBELIDÆ, 56 (*b*).

aa. Ventral fins abdominal, of numerous spines and soft rays; soft portion of the dorsal fin obsolete.....NOTACANTHIDÆ, 56 (*c*).

Family LVI (*b*).—MASTACEMBELIDÆ.

(*The Spiny Eels.*)

Body elongate, eel-like, naked or covered with very small scales. Mouth oblique, of moderate size, either the snout or the chin being produced in a fleshy appendage; lower jaw little movable; upper jaw not protractile. Teeth small. Gill-openings restricted to the region below the convexity of the operculum, the upper part of the operculum being covered by the skin of the scapular region; gill-membranes free from the isthmus; gills 4, a slit behind the fourth. Pseudobranchiæ small or obsolete. Tail isocercal. Dorsal fin very long, the anterior part composed of low, free spines, the posterior of soft rays; anal fin with or without spines; caudal fin separate or not. Ventral fins wanting; pectorals small. Air-bladder present. Branchiostegals 6; pyloric cœca 2 (in *Mastacembelus*). Fishes of the fresh waters of the East Indies. Genera 2; species about 14. We follow Dr. Bean in attaching provisionally to this family a singular fish from

the North Pacific, the osteology of which is unknown, and which may really belong to the *Acanthopteri.*

(*Mastacembelidæ* Günther, iii, 539–543.)

a. Scales none or rudimentary; body very elongate, tapering backward to a point. (*Ptilichthyinæ.*)

b. Lower jaw with a projecting fleshy appendage at tip; gill-membranes broadly united..... .....PTILICHTHYS, 179.

179.—PTILICHTHYS Bean.

(Bean, Proc. U. S. Nat. Mus. iv, 1881: type *Ptilichthys goodei* Bean.)

Body extremely elongate, serpentiform, little compressed, the tail tapering to a point. Skin naked, or with a few thin, loose, scattered scales; no lateral line. Head unarmed, rather small; upper jaw not protractile; snout short; mouth oblique; lower jaw projecting considerably beyond the upper, with a protruding fleshy appendage at tip. Maxillary reaching the front of eye. Mandible little movable. Both jaws with fine, close-set, sharp teeth, in one row, the posterior teeth a little the largest; no evident teeth on vomer or palatines. Gill-openings restricted to below the most convex part of the opercle; the membranes broadly united below, free from the isthmus. Gills 4, a slit behind the fourth. Pseudobranchiæ very small, almost obsolete. Gill-rakers short and stout. Pectorals short; ventrals wanting; dorsal beginning close behind the nape; the anterior portion for about half the length of the body composed of very low, stiff, free spines, hooked backwards, the posterior portion higher, of slender soft rays connected by thin membrane. No caudal fin, the tip of the tail free. Anal similar to the soft dorsal, without spines. Vent at considerable distance from the head. North Pacific. (πτίλον, quill; ἰχθύς fish.)

594. P. goodei Bean.

Orange or yellowish, the body with a blackish longitudinal stripe, the anal darker in color than the dorsal. Eye rather large, as long as snout, 5 in head; cheeks and opercles long; pectoral fin half as long as the head; soft dorsal and anal deeper than the body posteriorly, the anal a little lower than the dorsal. Vent near the end of the anterior third of the body; distance from the vent to the beginning of the soft dorsal $3\frac{1}{4}$ times the length of the head; length of head twice its greatest depth, $5\frac{1}{2}$ in the distance to the vent; appendage of mandible half as long as eye; free tip of caudal two-thirds eye. Dorsal spines 90; soft rays of dorsal 145; of anal about 185; P. 12. L. about 12 inches. Aleutian Islands.

(Bean, Proc. U. S. Nat. Mus. iv, 1881.)

Family LVI (*c*).—NOTACANTHIDÆ.

(*The Notacanthid Fishes.*)

Body elongate, somewhat compressed, covered with very small scales; head scaly; lateral line present. Head short, the snout protruding beyond the mouth, which is of moderate size, horizontal; both jaws with a series of slender, close-set teeth. Eye lateral, rather small. Gill-openings wide, not restricted above, the membranes not united, free from the isthmus. Pseudobranchiæ none. Gill-rakers long, slender. Gills 4, a slit behind the fourth. Dorsal fin short, median, composed of a few very short free spines, with sometimes a single soft ray. Anal fin very long, moderately high, beginning near the middle of the body and extending along the lower side of the band-like tail, confluent with the small caudal; anteriorly with numerous spines. Ventrals abdominal, nearly median, of 2–4 inarticulate and about 8 soft rays; the fins very close to each other, and often completely united. Pectorals short, placed rather high. Genera 2, species about 6; deep-water fishes, found in most seas.

(*Notacanthi* Günther, iii, 544.)

a. Dorsal spines 6–12; snout without proboscis .....Notacanthus, 180.

180.—NOTACANTHUS Bloch.

(*Acanthonotus* Bloch: *Campylodon* Fabricius.)

(Bloch, Abh. der Böhm. Gesellsch. 1787: type *Notacanthus chemnitzi* Bloch = *Acanthonotus nasus* Bloch, Ausländische Fische, xii, 114: *fide* Gill.)

Snout not produced into a proboscis. Dorsal spines 12–15. Characters of the genus otherwise included above. (νῶτος, back; ακανθα, spine.)

595. N. chemnitzi Bloch.

Color plain, or with dusky bands on the back. First spine of the dorsal opposite the ventral fin; no soft ray in the axil of the last spine. Ventrals close together, and joined by the internal border of their membranes. Pectorals 13 times in the length of the fish; ventrals 22 times in length. Head 8 in length; depth 12. B. 8; D. X; A. XIII, 116; C. 8.; P. 17; V. III, 8. Lat. l. 400. (*Valenciennes.*) Coast of Greenland. This or some other closely related species has been lately taken in deep water off the coast of New England.

("*Notacanthus chemnitzi* Bloch, Abh. der Böhm. Gesellsch. 1787": *Acanthonotus nasus* Bloch, Ausl. Fische, xii, 114: *Acanthonotus nasus* Bloch & Schneider, Syst. Ichth. 390: *Notacanthus nasus* Cuv. & Val. viii, 467: *Notacanthus nasus* Günther, iii, 54: *Campylodon fabricii* Reinh. Vidensk. Selsk. Afhandl. 1838, 120.)

Order Q.—SYNENTOGNATHI.

(*The Synentognathous Fishes.*)

Lower pharyngeal bones fully united; second and third superior pharyngeals much enlarged, oval, not articulated to the cranium, sending processes forwards; the fourth wanting. Ventral fins abdominal, without spine, the rays more than 5. Scapula suspended to the cranium by a post-temporal bone, which is slender and furcate. Parietal bone much reduced. Supraclavicle not distinct; no interclavicle. Basis of cranium double in front, but without muscular tube. Fins without spines. Air-bladder usually large, without pneumatic duct. This order includes only the family of *Scomberesocidæ*, and marks the transition from the *Physostomi* to the *Acanthopteri*. Its relations with the *Haplomi* are very intimate. (συν, together; εντος, within; γναθος, jaw.)

(*Physostomi* pt. family *Scomberesocidæ* Günther, vi, 233–298.)

Family LVII.—SCOMBERESOCIDÆ.

(*The Gar-fishes and Flying-fishes.*)

Body oblong or elongate, covered with cycloid scales, which are usually deciduous. Lateral line running very low, along the sides of the belly. Head more or less scaly, usually with vertical sides. Mouth various, the jaws being often prolonged into a beak. Premaxillaries not protractile, hinged at base mesially; margin of the upper jaw chiefly formed by the premaxillaries; the short maxillaries often entering the lateral margin; maxillary often anchyclosed with the premaxillary; its edge slipping under the front of the preorbital. Dentition various. Dorsal fin without spines, inserted on the posterior part of the body, opposite the anal and usually similar to it. Ventrals abdominal, of several soft rays, usually inserted posteriorly. No adipose fin. Pectoral fin inserted high, sometimes used as an organ of flight. Caudal fin usually forked, the lower lobe the longer. Vent close in front of anal. Nostrils large, double, near the eye. Lower pharyngeals fully united. Gill-membranes not united, free from the isthmus. Pseudobranchiæ hidden, glandular. Gill-rakers various. Gills 4, a slit behind the fourth. Air-bladder usually large, sometimes cellular. Intestinal canal usually simple, without cœca. Carnivorous. One genus (*Zenarchop-*

terus) viviparous, the other oviparous. Genera about 8, species 160; abounding in all warm seas, some of them entering fresh waters.

(*Scomberesocidæ* Günther, vi, 233–298.)

* Jaws with sharp, wide-set teeth; both jaws prolonged, forming a beak; finlets none. (*Belloninæ.*)

a. Gill-rakers none; no teeth on vomer or palatines.....TYLOSURUS, 181.

** Jaws with very small teeth, or none.

b. Maxillary anchylosed to premaxillary.

c. Both jaws more or less prolonged; dorsal and anal with finlets. (*Scomberesocinæ.*).....SCOMBERESOX, 182.

cc. Lower jaw only produced; no finlets. (*Hemirhamphinæ.*)

d. Anal fin of the male not modified; species oviparous.

HEMIRHAMPHUS, 183.

bb. Maxillary separate from premaxillary; neither jaw produced; no finlets; pectoral fins elongate. (*Exocœtinæ.*)

e. Ventrals anteriorly placed, not reaching to the anal.HALOCYPSELUS, 184.

ee. Ventrals posteriorly placed, reaching past front of anal.

f. Chin without barbel.....EXOCŒTUS, 185.

ff. Chin with one or two barbels or fleshy appendages.CYPSELURUS, 186.

181.—TYLOSURUS Cocco.

Gar-fishes.

(Cocco, Lettere in Giornale Sci. Let. Sicilia, xvii, 18: type *Tylosurus* cantraini* Cocco = *Esox imperialis* Raf.)

Body elongate, very slender, not much compressed. Both jaws prolonged into a beak, the lower jaw somewhat the longer, much the longer in young fishes, the very young resembling *Hemirhamphus.* Both jaws armed with a band of small, sharp teeth, besides which is a series of longer, wide-set, sharp, conical, unequal teeth. No teeth on vomer or palatines. Maxillaries grown fast to premaxillaries. Scales small, deciduous. Lateral line running along the side of the belly, becoming median on the tail. No finlets. Dorsal fin usually elevated anteriorly. Caudal fin short, truncate or forked. Pectorals and ventrals small, the latter inserted behind the middle of the body. Gill-rakers obsolete. Air-bladder present. Ovary single. Bones usually green. Size comparatively large. Species numerous. Voracious fishes, found in most seas. This genus differs from *Belone*† (*Belone vulgaris* Cuvier) in the absence of gill-rakers and vomerine teeth. (τύλος, callous; οὐρά, tail; in allusion

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* We are informed by Dr. Vinciguerra, of Genoa, that the gill-rakers are obsolete in *Tylosurus imperialis*, as in all the American species formerly referred to *Belone.*

† Cuvier, Règne Anim. ii, 1817: type *Esox belone* L. = *Belone vulgaris* Fleming. (βελόνη, an ancient name of some fish whose "belly splits to allow the escape of the eggs, the wound afterwards healing," doubtless *Syngnathus*; βέλος, a dart.)

to the caudal keel, on which the genus was originally based, a character of little importance.)

a. Caudal peduncle not keeled.

b. Posterior rays of the dorsal prolonged, longer than the anterior rays.

596. T. hians (C. & V.) J. & G.

Olive green above, silvery below, sides with a row of obscure dusky blotches in the young; posterior portion of dorsal fin black. Snout a third longer than the rest of the head. Maxillary hidden by the preorbital. Dorsal beginning opposite front of anal, its posterior rays much elevated, their tips reaching beyond base of caudal. Anal fin slightly falcate, the last rays very low. Tail compressed, deeper than broad. Head 3 in length. D. 26; A. 27. Virginia to the West Indies and the west coast of Mexico, occasional on our coast.

(*Belone hians* Cuvier & Valenciennes, xviii, 432: *Belone hians* Günther, vi, 248.)

bb. Middle and posterior rays of dorsal short, subequal.

c. Dorsal and anal long, each with more than 20 rays.

597. T. latimanus (Poey) J. & G.

Green above, white below. Head and body elongate. Eye $10\frac{1}{2}$ in head. Beak twice as long as the rest of the head. Pectoral rather long and pointed, broader and shorter than in *T. longirostris*. Bones not green. Caudal forked. B. 24; D. 24; A. 25. Cuba; occasional on our Atlantic coast. (Buzzard's Bay; *Goode*.)

(*Belone latimana* Poey, Mem. Cuba, ii, 292, 1860: *Belone latimanus* Günther, vi. 249: *Belone latimana* Goode, Proc. U. S. Nat. Mus. 1878, 6.)

cc. Dorsal and anal shorter, each with less than 20 rays.

d. Tail compressed, deeper than broad.

598. T. notatus (Poey) J. & G.

Green above, yellow below; vertical fins bluish, their tips tinged with orange. Free portion of tail compressed, deeper than broad. Head flat above, with deep scaly median groove. Superciliary region striated. Base of premaxillaries depressed; maxillary hidden by the preorbital. Teeth moderate, wide-set; no vomerine teeth. Eye less than interorbital space, $\frac{2}{5}$ the postorbital part of head. Body broad, subcylindrical. Pectoral as long as postorbital part of head; ventrals very small; anal scaly at base; caudal slightly emarginate. Scales rather large. Head $2\frac{1}{2}$. D. 13; A. 14. (*Günther*.) West Indies, north to West Florida.

(*Belone notata* Poey, Mem. Cuba, ii, 293, 1860: *Belone notata* Günther, vi, 248: *Belone notata* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 151.)

dd. Tail depressed, broader than deep.

599. T. longirostris (Mitchill) J. & G.—*Gar-fish; Bill-fish; Needle-fish.*

Olive green above, silvery below; a silvery lateral stripe; a dark spot above root of pectoral; fins nearly plain. Free portion of tail moderately depressed, not keeled. Head long, flat above, with a broad, rather shallow, scaly median groove. Top of head not rugose, usually faintly striate. Maxillary rather more than half hidden by the preorbital. Teeth moderate; no vomerine teeth. Gill-rakers obsolete. Body subcylindrical, its depth less than the length of the pectoral, which is about equal to the postorbital part of the head. Ventrals a little nearer the head than the caudal; dorsal and anal somewhat falcate; caudal fin truncate, or slightly emarginate. Scales thin and small, deciduous. Head $2\frac{3}{4}$; snout 4. D. 15; A. 18. L. 4 feet. Maine to Brazil; very abundant on our Atlantic coast. It often ascends rivers far above tide-water.

(*Esox longirostris* Mitch. Amer. Month. Mag. ii, 322, 1817: *Belone truncata* Le Sueur, Journ. Acad. Nat. Sci. Phila. ii, 126, 1821: *Belone truncata* Günther, vi, 244: *Belone scrutator* Grd. U. S. Mex. Bound. Surv. Ichth. 30.)

aa. Caudal peduncle keeled.

600. T. exilis (Grd.) J. & G.—*Needle-fish.*

Translucent green, silvery below; an olivaceous vertebral streak and a bluish lateral band; fins plain. Body very slender; head long. Eye more than a third of the postorbital region. Maxillary not nearly all hidden by the narrow preorbital. Top of head flattish, with a broad scaly groove. Pectoral fin shorter than postorbital part of head, its length more than greatest depth of body; ventrals short, a little nearer head than caudal; dorsal and anal falcate, rather low, the anal beginning before dorsal and ending in front of its last ray; caudal fin unequally lunate. Scales very small and thin. Head $3\frac{1}{8}$. D. 15; A. 17. L. 3 feet. Coast of California, from Point Concepcion southward; abundant.

(*Belone exilis* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 149: *Belone exilis* Girard, U. S. Pac. R. R. Surv. Fish. 158: *Belone exilis* Günther, vi, 238.)

182.—SCOMBERESOX Lacépède.

Sauries.

(*Sayris* Rafinesque: *Grammiconotus* Costa.)

(Lacépède, Hist. Nat. Poiss. v, 344, 1803: type *Scomberesox camperi* Lac. = *Esox saurus* Walb.)

Body elongate, compressed, covered with small, thin, deciduous scales. Jaws more or less prolonged, sometimes forming a beak, provided

with very feeble teeth; lower jaw the longer. Maxillaries joined to premaxillaries. Pectorals and ventrals small; dorsal small, opposite anal; last 4–6 rays of dorsal and anal detached, forming finlets. No pyloric cœca. Air-bladder large. Gill-rakers numerous, long and slender. Size rather small. Species 2 or more, ranging widely in the open sea. (*Scomber; Esox.*)

a. Jaws produced in a beak.

601. S. saurus (Walb.) Fleming.—*Saury; Skipper; Bill-fish.*

Olive brown above, sides and below silvery; a distinct silvery band as broad as the eye bounding the dark of the back. Head broad above, narrowed below, tapering anteriorly to the very slender pointed beak; snout longer than the rest of the head. Fins all small; caudal fin forked; ventrals midway between base of caudal and front of eye. Head 3½ in length; depth 9. D. 9—VI; A. 12—VI; Lat. l. 110. L. 18 inches. Atlantic Ocean; rather common on both coasts, and found in the open seas.

(*Esox saurus* Walbaum, Artedi, Pisc. iii, 93, 1792: *Scomberesox camperi* Cuv. & Val. xviii, 464: *Scomberesox scutellatum* Le Sueur, Journ. Acad. Nat. Sci. Phila. ii, 132, 1821; Fleming, Brit. Anim. 184; Günther, vi, 257: *Scomberesox storeri* Storer, Hist. Fish. Mass. 315: ? *Scomberesox rondeleti* Günther, vi, 257.)

aa. Jaws scarcely produced, not forming a beak.

602. S. brevirostris Peters.

Dark green above, silvery below; sides with a lateral silvery stripe, bounded above by a dusky streak; upper fins mostly dusky; lower pale. Body much elongate, compressed, widest above, the abdomen and lower edge of head trenchant. Upper jaw conical, not produced, ending in a very acute tip; lower jaw slightly longer, its tip produced for a very slight distance, and flexible; triangular portion of premaxillaries as long as broad; snout a little more than half length of rest of head; interorbital space flat; maxillary reaching front of orbit. Teeth very minute, in a single row in each jaw. Eye large, in front of middle of head. Pectoral fin somewhat emarginate, ⅓ length of head; ventrals small, far back, slightly nearer tip of snout than tip of lower lobe of caudal; dorsal inserted slightly behind front of anal; both fins low, the finlets small; caudal widely forked, the lobes equal. Scales small, deciduous, those on top of head forming an elliptical patch. Head 5½; depth 9. D. 9—VI; A. 12—VI; Lat. l. ca. 125. L. 14 inches. Coast of California; rare.

(Peters, Monatsbericht Akad. Wiss. Berl. July, 1866, 521: ? *Scomberesox saira* Günther, vi, 258.)

183.—HEMIRHAMPHUS Cuvier.

Half-beaks.

(Cuvier, Règne Anim. ii, 1817: type *Hemirhamphus commersoni* Cuvier.)

Body elongate, compressed, the dorsal outline parallel with that of the belly. Upper jaw short; lower jaw prolonged into a slender beak, bordered with membrane; premaxillaries forming a triangular plate, the teeth of which fit against the toothed portion of the mandible; maxillaries joined to premaxillaries. Teeth feeble, sometimes tricuspid. Gill-rakers rather long. Head covered above with large, shield-like scales. Scales large, deciduous. No finlets; caudal fin more or less forked, the lower lobe the longer; dorsal and anal similar, not modified in the males. Oviparous. Air-bladder large. No pyloric cœca. Young with the lower jaw short. Species numerous, in all warm seas, going in large schools. Size comparatively small. (*ἡμι*, half; *ῥάμφος*, beak.)

a. Pectoral fins short; ventrals moderate. (*Hemirhamphus.*)

603. H. unifasciatus Ranzani.

Greenish, sides with a well-defined silvery band, narrower than the eye, about as broad as a scale. Tip of lower jaw red. Lower jaw (from end of upper jaw) $4\frac{1}{2}$–$5\frac{1}{2}$ in total length from its tip to base of caudal. Head (without mandible) $4\frac{1}{3}$ in length from tip of upper jaw. Premaxillaries broader than long. Eye about equal to interorbital space, $\frac{2}{3}$ postorbital part of head. Ventrals nearly midway between eye and base of caudal. Dorsal and anal scaly. Caudal moderately forked, the middle rays being longer than the eye. Back not compressed. Head (with lower jaw) $2\frac{3}{4}$–3; depth $7\frac{1}{2}$. D. 14; A. 15; Lat. l. 54. L. 12 inches. Cape Cod to Panama and Indian Ocean; common on our South Atlantic coast.

(Ranzani, Nov. Comm. Acad. Sci. Inst. Bonon. 1842, v, 326, tab. 25; Günther, vi, 262: *Hemirhamphus richardi* Cuv. et Val. xix, 26.)

604. H. rosæ Jordan & Gilbert.

Green, with a silvery lateral band, rather broader than a scale. A triple vertebral streak. Lower jaw dark reddish brown. Lower jaw (from tip of upper) $4\frac{1}{2}$ in length from its tip to base of caudal. Head without mandible $3\frac{4}{5}$ in length from tip of upper jaw. Premaxillaries about as broad as long. Eye less than interorbital space, about half postorbital part of head. Ventrals rather nearer tip of caudal than eye, midway between base of caudal and gill-opening. Dorsal and anal

fins not scaly. Caudal moderately forked, the middle rays being twice the length of the eye. Pectorals shorter than postorbital part of head. Ventrals a little shorter. Back broad. Head (with lower jaw) $2\frac{2}{3}$. D. 14; A. 14; Lat. l. 63. Southern California, not very common.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 335.)

aa. Pectoral fins very long; ventrals very short; body very slender. (*Euleptorhamphus** Gill.)

605. H. longirostris Cuvier.

Olivaceous, sides silvery. Body extremely slender and elongated, much compressed, almost band-like. Back thin, subcarinate. Lower jaw very slender and long, much longer than the rest of the head. Teeth very feeble. Eye large, about equal to snout. Pectoral fins long and slender, half as long as mandible, more than one-fourth the length of the rest of the body. Upper rays of pectorals broad and compressed. Ventrals not longer than eye, inserted far back. Caudal fin unequally forked, the lower lobe the longer. Head $6\frac{2}{3}$; depth 10. Mandible about 3. D. 22; A. 19; V. 6. L. 18 inches. Cape Cod to Indian Ocean, in the open sea; rare on our Atlantic coast.

(Cuvier, Règne Anim.; Günther, vi, 276: *Hemirhamphus macrorhynchus* Günther, vi, 276: *Euleptorhamphus longirostris* Putnam, Proc. Bost. Soc. Nat. Hist. 1870, 238.)

184.—HALOCYPSELUS Weinland.

(Weinland, Proc. Bost. Soc. Nat. Hist. 1859, vi, 385: "type *Exocœtus mesogaster* Mitch.")

This genus differs from *Exocœtus* mainly in the anterior position and small size of the ventral fins, which terminate in advance of the anal fin, and are not used as organs of flight. Species not very numerous. (ἅλς, sea; κύψελος, a swallow.)

606. H. evolans (L.) Weinl.

Olivaceous above, with dark specks; silvery below, with a bright blue lustre. Pectoral fins black above and behind, the lower border whitish. Snout obtuse and short, $\frac{3}{4}$ the diameter of the eye. Eye not large, $4\frac{1}{4}$ in head, less than the width of the broad, rather convex, interorbital space. Distance from snout to first ray of ventral about equal to distance between root of ventrals and last ray of dorsal. Pectoral fins long, $\frac{4}{5}$ the length of the body, reaching the root of the caudal; second

*Gill, Proc: Acad. Nat. Sci. Phila. 1859, 131: type *Euleptorhamphus brevoorti* Gill= *Hemirhamphus longirostris* Cuvier. (ἐυλέπτος, very slender; ῥαμφος, beak.)

ray of pectoral divided, third ray longest. Ventral fins not reaching nearly to vent. Dorsal inserted a little in advance of front of anal, its anterior rays not half so long as the head; 20 scales in front of dorsal and 6 between dorsal and lateral line. Gill-rakers long and slender. Head 4; depth 5½. D. 13; A. 13. Lat. l. 42; Vert. 25 + 19. In most warm seas, not rare on our Atlantic coast, where it spawns in summer.

(*Exocœtus evolans* L. Syst. Nat. i, 521: *Exocœtus evolans* Günther, vi, 282: *Exocœtus evolans* Lütken, Vidensk. Meddel. Naturh. Foren. 1876, 102; Weinland, l. c.)

607. H. obtusirostris (Günther) J. & G.

Very similar to *H. evolans*, but with the dorsal fin inserted above or behind the first ray of the anal; the distance from the snout to the first ray of the ventrals less than the distance between the root of the ventrals and last ray of the dorsal; 7 to 8 rows of scales above the lateral line; fins more distinctly marked. D. 13; A. 13. Lat. l. 40. (*Lütken.*) Tropical seas, north to Louisiana.

(*Exocœtus obtusirostris* Günther, vi, 283: *Exocœtus obtusirostris* Lütken, Vidensk. Meddel. Naturh. Foren. 1876, 102.)

185.—EXOCŒTUS Linnæus.

Flying-fishes.

(Artedi; Linnæus, Syst. Nat.: type *Exocœtus volitans* L.)

Body elongate, broad above, somewhat compressed. Head short, blunt, narrowed below. Mouth small. Jaws very short, about equal. Chin without barbel. Maxillaries not joined to the premaxillaries. Teeth very feeble or wanting. Eyes large. Gill-rakers moderate. Scales large, deciduous. No finlets. Dorsal fin short, opposite anal. Caudal widely forked, the lower lobe the longer. Pectoral fins very long, reaching past the beginning of the anal, and serving as organs of flight, their great size enabling these fishes to sustain themselves in the air for some time.* Ventral fins large, posteriorly inserted, also used as organs of flight. Air-bladder very large. No pyloric cœca. Species numerous in all warm seas. (ἐξώκοιτος, sleeping out; the ancient name of these fishes, which were supposed to come out on the beach to sleep at night.)

* These fishes are enabled to sustain themselves in the air for upwards of a minute. Their movements are exceedingly rapid. Their impulse, apparently, comes mainly from the strong tail, which has a sculling motion in the water, by which they acquire a great velocity. When they first emerge from the water, the pectorals are spread and vibrate rapidly, like the wings of an insect, and the ventrals are closed. The motion of the pectoral is simultaneous with the motion of the tail, and is probably caused by the latter. When they reach a horizontal position in the air, the pectorals and ventrals are spread, and apparently used only to retain the impulse previously received.

608. E. californicus Cooper.—*Flying-fish; Volador.*

Steel-blue above and on both sides, belly abruptly silvery. Pectorals blackish, with the posterior edge paler; an obscure oblique pale band across lower part; caudal plain dusky; ventrals pale, partly dusky; dorsal rather pale, with a dusky blotch above. Body stoutish. Lower jaw rather the longer; both jaws with minute teeth. Eye large, rather longer than snout, 3 in head, nearly equal to the diameter of the slightly concave interorbital space. Pectoral fin reaching past the dorsal and falling just short of the caudal. Second ray of pectoral divided, the third longest. Ventrals about reaching middle of anal, their length $3\frac{4}{5}$ in body, their insertion midway between middle of opercle and base of tail. Anterior rays of dorsal half the length of the head; 43 rows of scales between occiput and dorsal, 7 between the dorsal and the lateral line. Head 5; depth 6; D. 12; A. 10; Lat. l. 58. L. 18 inches. Southern California; very abundant in summer about the Santa Barbara Islands.

(Cooper, Proc. Cal. Acad. Nat. Sci. 1864, 93; Günther, vi, 295.)

609. E. noveboracensis Mitchill.

Dark bluish above; pectorals blackish, with the lower edge pale, in the young with two black bars; ventrals mesially blackish, the edges all white; caudal lobes mesially dusky, the edges pale. Head short; snout very blunt, shorter than the very large eye, which is narrower than the broad, concave, interorbital space. Pectoral fins very long, reaching past the base of the caudal; second ray of pectoral divided; ventrals reaching considerably past anal; their insertion midway between the preopercle and the base of the caudal. Dorsal fin inserted opposite anal. Head $4\frac{2}{3}$; depth $5\frac{1}{2}$. D. 11; A. 9. Lat. l. 42–48. North Atlantic; not rare on our coast.

(Mitchill, Amer. Month. Mag. ii, 233, 1817; DeKay, New York Fauna, Fishes, 230; ? Cuv. & Val. xix, 99.)

610. E. melanurus Cuv. & Val.

Bluish above, silvery below, the pectoral fin blackish, except a portion of its middle and inner edge; ventrals plain or nearly so. Head of moderate length, not very blunt, the interorbital space broad, wider than the eye and somewhat concave. Eye very large, longer than snout, 3 in head. Pectoral fin $1\frac{2}{3}$ in length, reaching past the base of the last dorsal ray and the tip of the last anal ray. Ventrals inserted midway between the posterior edge of the eye and the middle of the base of the caudal, their tips reaching nearly to the base of the last

anal ray; second ray of pectoral fin divided. Dorsal fin low, its insertion nearly opposite front of anal. Head 4; depth 6. D. 11; A. 9; scales 6–52–3. North Atlantic; occasional on our coast.

(??Cuv. & Val. Hist. Nat. Poiss. xix, 101; said to have a black blotch on the upper part of the base of the tail, recalling the coloration of species of *Sargus*, a feature not noticed by us on any of our flying-fish.)

611. E. exiliens Gmelin.

Bluish above, silvery below, sides with five broad, transverse bars; pectorals and ventrals irregularly banded and blotched with blue and black. Body very slender; snout short, $\frac{1}{6}$ length of head. Dorsal and anal fins similar and opposite. Ventrals inserted slightly behind the middle of the body; pectorals $1\frac{2}{3}$ in length of body; second ray of pectorals extending beyond the membrane in a spine-like process. Ventrals 3 in length. Head 6 in total length with caudal. D. 12; A. 12. Lat. l. 48. (*Goode.*) Atlantic Ocean; a small species, possibly the young of some other.

(Gmelin, Syst. Nat. i, 1400, 1788; Günther, vi, 291; Goode, Bull. U. S. Nat. Mus. v, 64.)

186.—CYPSELURUS Swainson.

Bearded Flying-fishes.

(*Cypsilurus* Swainson, Classification of Fishes, 1839, 296: type *Exocœtus nuttalli* Le Sueur.)

This genus differs from *Exocœtus* in the presence of one or more barbels or cutaneous appendages of delicate texture on the tip of the mandible. The species are all of small size, and it is possible that in some of them these appendages are lost with age. (κύψελος, a swift or swallow; οὐρά, tail.)

612. C. furcatus (Mitch.) Weinland.

Barbels 2, ribbon-like, usually little if any longer than the eye. Eye large, narrower than the broadly, slightly concave, interocular space. Adult nearly plain; young with three broad, black bands across the belly in front of the ventrals; operculum and pectorals marbled with black; lower caudal lobe with three blackish cross-bands; posterior part of ventral and lower part of anal black. Ventrals and pectorals reaching past base of caudal; ventrals inserted nearer the root of the caudal than the snout; dorsal very high, higher than the body, the longest rays not reaching the caudal. Anal not low. Head 4 in

length, not very short nor very blunt. D. 13; A. 9. Atlantic Ocean; not very common on our coasts.

(*Exocœtus furcatus* Mitch. Trans. Lit. and Phil. Soc. i, 449, 1815; *Exocœtus furcatus* Günther, vi, 286: *Exocœtus nuttalli* Le Sueur, Journ. Acad. Nat. Sci. Phila. 1821, 10: *Exocœtus nuttallii* Günther, vi, 286: *Exocœtus furcatus* Lütken, Vidensk. Meddel. Naturh. Foren. 1876, 106; Weinl. l. c.)

613. C. comatus (Mitch.) Weinland.

Greenish above, paler below; ventrals somewhat dusky; lower edge of pectorals pale. Body moderately elongate; head medium; eye very large, longer than snout, about 3 in head. Barbel very long, ribbon-like, reaching in the adult as far as the base of the ventrals; a small similar barbel, shorter than the eye, on each side of it at base. Pectoral fins reaching to last ray of dorsal, the third ray longest, the second split. Insertion of dorsal nearly midway between ventrals and anal; ventrals slightly nearer gill-openings than base of caudal, their tips nearly reaching end of anal, which is smaller than dorsal; caudal well forked, the lower lobe longest. Head 4; depth $5\frac{2}{3}$. D. 12; A. 9; Lat. l. 47. L. 8 inches. (*Lütken.*) Atlantic Ocean; occasional on our coast.

(*Exocœtus comatus* Mitch. Trans. Lit. and Phil. Soc. N. Y. i, 448: *Exocœtus comatus* Günther, vi, 286: *Exocœtus comatus* DeKay, New York Fauna, Fishes, 231: *Exocœtus appendiculatus* Wood, Journ. Acad. Nat. Sci. Phila. 1824, 283: *Exocœtus comatus* Lütken, Vidensk. Meddel. Natur. Foren. 1876, 106, fig. 1.

Order R.—LOPHOBRANCHII.

(*The Lophobranchs.*)

Gills tufted, not laminated, composed of small rounded lobes attached to the gill-arches. Scapula suspended to the cranium by a post-temporal. Superior branchihyals and pharyngeals, and basal branchihyals wanting or not ossified. Mouth very small, bounded above by the premaxillaries. Post-temporal simple, co-ossified with the cranium; basis of the cranium simple. Pectoral fins with elevated bases. Interclavicles well developed. Anterior vertebræ modified, the diapophyses much expanded. Air-bladder simple, without air-duct. Snout produced, bearing the small toothless mouth at the end. Gill-covers reduced to a large simple plate. Skin with bony plates. Muscular system little developed. The families mentioned below have neither spinous dorsal, nor ventral fins; the *Solenostomatidæ* of the Indian Ocean have all the fins well developed. (λόφος, crest; βράγχια, gills.)

(*Lophobranchii* Günther, viii, 150–203.)

ANALYSIS OF THE FAMILIES OF LOPHOBRANCHII.

a. No spinous dorsal fin; no ventral fins; gill-openings narrow.
b. Axis of head in a line with that of the body.....SYNGNATHIDÆ, 58.
bb. Axis of the head forming an angle with that of the body..HIPPOCAMPIDÆ, 59.

FAMILY LVIII.—SYNGNATHIDÆ.

The Pipe-fishes.

Body elongate, very slender, covered with bony plates. Head slender, its axis continuous with that of the body. Snout long, tube-like, bearing the short toothless jaws at the end. Gill-openings reduced to a small aperture behind the upper part of the opercle. Tail long, not prehensile, usually provided with a small caudal fin. Male fishes with an egg pouch, usually placed on the under side of the tail, sometimes on the abdomen, and formed of two folds of skin which meet on the median line. The eggs are received into this pouch and retained until some time after hatching, when the pouch opens, permitting the young to escape. Dorsal fin single, nearly median, of soft rays only; pectorals present, small; ventrals none; anal fin minute, usually present. Genera 10 or more; species 120. Small fishes, found in all warm seas, sometimes entering fresh waters.

(*Syngnathidæ*, group *Syngnathina* Günther, viii, 153–193.)

a Humeral bones united below; caudal fin present; pectoral fins well developed; dorsal nearly opposite the vent.....SIPHOSTOMA, 187.

187.—SIPHOSTOMA* Rafinesque.

(*Syngnathus* of most recent authors.)

(Rafinesque, Caratteri di alcuni Nuovi Generi, 18, 1810: type *Syngnathus pelagicus* L.)

Body elongate, very slender, six or seven angled, not compressed, tapering into a very long tail; the dorsal keels of the trunk not continuous with those of the tail. Head slender, tapering into a long tube-like, sub terete snout, which bears the very short, toothless jaws at the end. Humeral bones firmly united with the "breast-ring." Body covered with a series of bony, keeled, radiated plates, arranged in linear series. Dorsal fin distinct, rather short, opposite the vent, which is near the middle of the body; caudal fin present, rather small; anal fin

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* The genus *Syngnathus* of Linnæus, originally equivalent to the modern order of *Lophobranchii*, was first subdivided by Rafinesque in 1810. The name *Siphostoma* was given to *S. pelagicus*, and its relatives, the *Syngnathus* of late writers, that of *Tiphle* to *S. typhle*, the *Siphonostoma* of late writers, while *Syngnathus* was retained for *S. æquoreus* and its relatives, the group now usually called *Nerophis*.

minute, close behind vent; pectorals developed, short and rather broad. Male fishes with an egg-pouch along the under side of the tail, formed by two cutaneous folds, and splitting lengthwise to extrude the young fishes. Species numerous, inhabiting all warm seas; abounding in bays among the sea-weeds, and entering the rivers. The species of this genus are subject to many variations, and their proper discrimination is very difficult. (*σιφον*, tube; *στόμα*, mouth.)

a. Breast shields not covered by skin; lower jaw projecting. (*Siphostoma.*)

b. Atlantic coast species.

614. S. fuscum (Storer) J. & G.—*Common Pipe-fish.*

Olivaceous; sides mottled and blotched as in other species; base of dorsal with darker spots. Muzzle shorter than the rest of the head. Occiput usually more or less keeled. Dorsal fin longer than the head, covering 4 + 5 rings. Distance from snout to dorsal 3 in total length. Belly in females scarcely carinate. Tail one-third longer than rest of body. Lateral line and upper caudal edge not continuous. Head 9. D. 35–40. Rings 18 + 37. L. 10. Atlantic coast, common northward; described from specimens from Wood's Holl, Mass.

(*Syngnathus fuscus* Storer, Rept. Fish. Mass. 1838, 162: *Siphonostoma fuscum* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 22: *Syngnathus peckianus* Storer, l. c. 163: *Syngnathus peckianus* Günther, viii, 157: *Syngnathus fasciatus* and *viridescens* DeKay, New York Fauna, Fish. 319–321: ? *Syngnathus affinis** Günther, viii, 164; from Louisiana.)

615. S. louisianæ (Günther) J. & G.

Color of other species; base of dorsal spotted. Muzzle longest in females, much longer than the rest of the head. Occiput somewhat keeled. Dorsal fin shorter than the head, on 3 + 5 rings. Distance from snout to dorsal $2\frac{1}{3}$ in total length. Belly in females scarcely

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* *S. affinis* (Günther) J. & G.

"The length of the snout is a little less than that of the remaining part of the head. Head nearly one-ninth of the total length. A distinct ridge runs along the median line of the snout and nuchal shields. Supraorbital ridge continued over the temples. Anterior part of the operculum with a faint ridge. Shields without spines. Tail longer than body. Caudal pouch half as long as the body. Lateral line interrupted. Vent below the posterior third of the dorsal, which occupies 9 rings, 5 of which are body-rings. Caudal fin well developed; anal fin rudimentary in the male. Back with indistinct brown cross-bars; a brown band from the eye along the snout." Total length 6 inches. Head 10 lines. Trunk $1\frac{3}{4}$ inch. Length to origin of dorsal fin 2 inches. Louisiana. (*Günther.*)

Another form or species has the body stouter and the color darker, the dorsal in the females very high, and blackish, with paler spots. Muzzle about equal to the rest of the head. Occiput somewhat carinated. Dorsal fin shorter than the head, on 3 + 5 rings. Distance from snout to dorsal $2\frac{1}{2}$ in length. Belly in the females with a sharp black carina. Head 7. D. 30–31. Rings 15 + 33. Saint John's River, Florida.

(*Siphonostoma* sp. Jordan, Proc. U. S. Nat. Mus. 1880, 22.)

carinated. Tail one-fifth longer than the rest of the body. Lateral line and upper caudal edge not continuous. Head 7. D. 33–37. Rings 18 + 33–20 + 38. L. 12 inches. Virginia to Texas; described from specimens from Beaufort, N. C.

(*Syngnathus louisianæ* Günther, viii, 160: *Siphonostoma louisianæ* Jordan, Proc. U. S. Nat. Mus. 1880, 22.)

bb. Pacific coast species.

616. S. californiense (Storer*) Gill.—*Big Pipe-fish.*

Olivaceous, varying to brownish red, yellowish below; head and body variously marbled and speckled with whitish, the markings posteriorly taking the form of short horizontal grayish streaks, anteriorly often forming narrow bars; usually a brownish lateral band. Top of head not carinated. Snout very long, from 1½ to 2 times the length of the rest of the head, its length proportionately greater in the adult, and usually greatest in males. Dorsal shorter than head. Lateral line not continuous with upper edge of tail. Belly not carinated. Opercle without ridge. Dorsal rays 42 (varying from 38 to 44). Rings 20 + 46 (those behind the vent varying from 40 to 48 in number; 40 to 43 in var. *griseolineatum*; 46 to 48 in var. *californiense*). L. 14 to 18 inches, much more than in our other species. Pacific coast of United States, everywhere common, especially northward.

(*Syngnathus californiensis* Storer, Proc. Bost. Soc. Nat. Hist. ii, 73, 1845: *Syngnathus californiensis* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 283: *Syngnathus griseolineatus* Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 14: *Syngnathus griseolineatus* Günther, vii, 160: *Syngnathus abbotti* Girard, U. S. Pac. R. R. Surv. Fish. 346: *Syngnathus californiensis* Girard, U. S. Pac. R. R. Surv. Fish. 344.)

617. S. leptorhynchus† (Girard) J. & G.

Yellowish brown or blackish, spotted or vermiculated. Head raised above, but usually not carinated. Snout 1½–1¾ times the length of the rest of the head. D. 30–35. Rings 17+37–43. L. 10 inches. Other-

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*Another form or species, occurring at Monterey and Santa Barbara, agrees with the preceding in size, color, plates, fin-rays, &c., but differs in having the snout short not longer than the rest of the head. The eyes are rather smaller than in *S. californiense*, and the keels are perhaps less sharp.

†Another common form, which is probably a variation of this species, is—

S. dimidiatum Gill.

Similar to *S. leptorhynchus*, but with the snout very short, scarcely as long as the rest of the head. Head slightly crested above. D. 30; rings 15 + 38. L. 8 inches. Coast of California, chiefly south of Point Concepcion.

(*Syngnathus brevirostris* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 156 (name preoccupied): *Syngnathus dimidiatus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 284: *Syngnathus dimidiatus* Günther, viii, 65.)

wise essentially as in *S. californiense.* Nuchal plates somewhat keeled in var. *leptorhynchus;* not keeled in var. *arundinaceum.* Coast of California, chiefly south of Point Concepcion; abundant.

(*Syngnathus leptorhynchus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 156: *Syngnathus leptorhynchus* Girard, U. S. Pac. R. R. Surv. Fish. 346: *Syngnathus leptorhynchus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 284: *Syngnathus arundinaceus* Girard & Gill, ll. cc.,)

aa. Breast shields covered by loose skin; lower jaw included. (*Dermatostethus** Gill.)

618. S. punctipinne (Gill) J. & G.

Brown; dorsal fin speckled. Body comparatively robust Snout moderate, a little longer than the rest of the head. Eye large. Occiput with a raised keel; joint between the occiput and the first dorsal shield more perfect than usual, so that the head can be placed at an angle with the body. Greatest depth about equal to length of post-orbital part of head. Skin on breast and anterior ventral plates thin, showing the striation of the bones. Tail twice as long as trunk. Head 8; D. 41; rings 19+39. L. 12. San Diego, Cal. Only the original types known.

(*Dermatostethus punctipinnis* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 283.)

Family LIX.—HIPPOCAMPIDÆ.

(*The Sea Horses.*)

Syngnathoid fishes destitute of caudal and ventral fins, and with the tail prehensile. Form of the body and head singular; in the typical genera the body is compressed, and the head, which is placed nearly at right angles with the axis of the body, is surmounted by a bony crest. These little fishes have thus a remarkably horse-like physiognomy, like that of the conventional "knight" at chess. Mouth very small, terminal. Dorsal fin median, of soft rays only; anal fin minute; pectoral short, with a broad base. Gill-openings very small. Egg-pouch of the male usually at the base of the tail. Genera about 4; species about 30, most of them belonging to *Hippocampus.* Fishes of the open seas of warm regions. They attach themselves by their tails to seaweed and other floating substances, and are often carried to great distances by currents.

(*Syngnathidæ*, group *Hippocampina* Günther, viii, 194–206.)

a Body compressed; occiput with a narrow bony crest, which is surmounted by a "coronet"; shields with tubercles or spines ..... HIPPOCAMPUS, 188.

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* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 283: type *Dermatostethus punctipinnis* Gill. (δερμα, skin; στεθος, breast.)

188.—HIPPOCAMPUS Rafinesque.*

Sea Horses.

(Rafinesque, Indice d'Ittiologia Siciliana, 1810, 37: type *Syngnathus hippocampus* L. = *Hippocampus heptagonus* Raf.)

Body strongly compressed, the belly gibbous, tapering abruptly to a long, quadrangular, prehensile tail. Head with a distinct curved neck, placed nearly at a right angle with the direction of the body, surmounted by a compressed occipital crest, on the top of which is an angular, star-shaped coronet; top and sides of the head with spines. Body and tail covered with bony plates, forming rings, those on the body each with 6 spines or tubercles, those of the tail with 4. Pectoral fins present; anal minute, usually present; dorsal fin moderate, opposite the vent. Egg-pouch in the male a sac at the base of the tail, terminating near the vent. Species numerous, in all warm seas. (ἱππόκαμπος, the ancient name, from ἱππος, horse; κάμπος, a wriggling sea-monster, or a caterpillar.)

619. H. heptagonus Raf.—*Sea Horse.*

Yellowish brown; eyes and cheeks with radiating wavy lines of light brown; snout with a narrow white cross-band near its middle (*fide Goode*); sides with a few small pale spots; dorsal dusky above. Tubercles of body and tail prominent, slightly recurved, usually provided with slender filaments, the tubercles of each alternate or each third ring on the back usually larger than the others. Occipital crest very high, with 5 tubercles, the anterior with long filaments. Snout as long as the opercle, which is marked with radiating striæ. D. 18; P. 18; A. 4. Rings 11 + 36. L. 5 inches. Warmer parts of the Atlantic; north to England and Newfoundland; rather rare on our coast. Very abundant in the Mediterranean. European examples examined by us are profusely spotted, the snout plain; ours is possibly a different species.

(*Syngnathus hippocampus* L. Syst. Nat.; Rafinesque, l. c. 37: *Hippocampus antiquorum* Leach, Zoöl. Misc. 1814, 104: *Hippocampus antiquorum* Günther, viii, 200: *Hippocampus antiquorum* Goode, Proc. U. S. Nat. Mus. 1878, 45: *Hippocampus brevirostris* Cuvier, Règne Anim.: *Hippocampus hudsonius* DeKay, N. Y. Fauna, Fishes, 322: *Hippocampus hudsonius* Storer, Hist. Fish. Mass. 416: ? *Hippocampus lævicaudatus* Günther, viii, 205, "tail without knobs.")

620. H. ingens Grd.

Chestnut brown, mottled with darker, and dotted with white. Body rather slender, its depth about equal to the distance from snout to pos-

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* = *Hippocampus* Leach, Zool. Misc. 1814, 103.

terior margin of orbit; tail longer than head and body together; snout rather shorter than opercle; supraorbital spine nearly half diameter of eye; coronet well developed, with five spines. D. 19; A. 4. Rings 10 + 38. San Diego, Cal., and southward; reaching a length of nearly a foot.

(Girard, U. S. Pac. R. R. Surv. Fishes, 1858, 342.)

Order S.—HEMIBRANCHII.

(*The Hemibranchs.*)

Superior branchihyal and pharyngeal bones reduced in number; inferior pharyngeals separated. Ventral fins abdominal or subabdominal. Mouth bounded above by premaxillaries only; interclavicles developed. No pneumatic duct to the air-bladder. (*Cope.*) There are also several striking peculiarities in the structure of the shoulder girdle and the skull, by which these fishes differ from the *Acanthopteri*, with which group under one name or another they have usually been combined. (ἡμι, half; βράγχια, gills.)

ANALYSIS OF FAMILIES OF HEMIBRANCHII.

* Bones of head produced into a long tube, which bears the short jaws at its end.

a. Body short, compressed, scaly; no teeth; spinous dorsal present.
CENTRISCIDÆ, 60.

aa. Body elongate; teeth present.

b. Dorsal spines none; a long caudal filament; no scales.....FISTULARIIDÆ, 61.

bb. Dorsal spines present, disconnected; no caudal filament.

c. Body covered with ctenoid scales.....AULOSTOMATIDÆ, 62.

cc. Body scaleless, with bony shields.....AULORHYNCHIDÆ, 63.

** Bones of head moderately produced; ventrals I, 1; dorsal preceded by free spines; body scaleless, naked or mailed.....GASTEROSTEIDÆ, 64.

Family LX.—CENTRISCIDÆ.

(*The Snipe-fishes.*)

Body compressed, oblong or elevated, covered with small rough scales; no lateral line; some bony strips on the side of the back and on the margin of the thorax and abdomen, the former sometimes confluent into a shield. Bones of the skull much prolonged anteriorly, forming a long tube which bears the short jaws at the end; no teeth. Gill-openings wide; branchiostegals 4. Two dorsal fins, the first of 4 to 7 spines, the second of which is very long and strong; soft dorsal and anal moderate; ventral fins small, abdominal, of 5 soft rays; pectorals short; caudal fin emarginate, its middle rays not produced. Air-bladder large; pseudo-

branchiæ present. Gills 4, a slit behind the fourth. No pyloric cœca; intestinal canal short. A single genus of three or more species, chiefly of the Old World, one of them straying to America.

(*Centriscidæ* part, genus *Centriscus* Günther, iii, 518–524.)

189.—CENTRISCUS Linnæus.

Snipe-fishes.

(Linnæus, Syst. Nat. 1758: type *Centriscus scolopax* L.)

The characters of the genus are included above. (κεντρίσκος, an ancient name of some spinous fish; from κέντρον, a spine.)

621. C. scolopax Linn.—*Snipe-fish; Trumpet-fish; Bellows-fish.*

Rose red or reddish olive above, silvery on the sides and belly. Body strongly compressed and somewhat elevated, covered with small striated scales, each stria terminating in a rather strong spine; second dorsal spine very strong, serrated posteriorly, its length about $\frac{1}{6}$ total length of fish; snout several times longer than the rest of the head. Head $2\frac{1}{2}$ in length; depth $3\frac{1}{2}$ to 4. D. V–12; A. 20. Mediterranean Sea; occasional northward; accidental on our coast.

(Linn. Syst. Nat.; Günther, iii, 518.)

Family LXI.—FISTULARIIDÆ.

(*The Trumpet-fishes.*)

Body extremely elongate, much depressed, broader than deep. No scales. Bony plates present on various parts of the body. Head very long, the anterior bones of the skull much produced, forming a long tube, which terminates in the narrow mouth; both jaws, and usually the vomer and palatines also, with minute teeth; membrane uniting the bones of the tube below, very lax, so that the tube is capable of much dilation. Branchiostegals 5–7; gills 4, a slit behind the fourth. Gill-membranes separate, free from the isthmus; gill-rakers obsolete. Pseudobranchiæ present. Air-bladder large. Spinous dorsal fin entirely absent; soft dorsal short, posterior, somewhat elevated; anal fin opposite it and similar; caudal fin forked, the middle rays produced into a long filament; pectorals small, with a broad base, preceded by a smooth area as in *Gasterosteidæ;* ventral fins very small, wide apart, abdominal, far in advance of the dorsal, composed of 6 soft rays. Pyloric cœca few; intestines short. Vertebræ very numerous (4 + 49 + 33). Fishes of the tropical seas, related to the Sticklebacks in structure, but

with prolonged snout and different ventral fins. A single genus, *Fistularia*, with two or more species.

(*Fistularidæ*, part, genus *Fistularia* Günther, iii, 529–535.)

190.—FISTULARIA Linnæus.

Trumpet-fishes.

(Linnæus, Syst. Nat. 1758: type *Fistularia tabaccaria* L.)

Characters of the genus included above. The bony shields, characteristic of this genus, are thus enumerated by Dr. Günther:

"1. A narrow strip along the median line of the back behind the skull (confluent neural spines).

"2. The pair of broader lateral dorsal shields are peculiar bones, separated processes of the occipital bone—similar to those we have observed in *Mugil*, where, however, they are not separated from the occipital, and arise more outwardly than in *Fistularia*. These shields are the longest, provided anteriorly with a ridge, which is prolonged and extends far backwards between the muscles of the back. This ridge is flexible, and does not interfere with the lateral movements of the fish; it appears to serve as a base for the attachment of muscular fibres.

"3. The narrow shield on the side is the coracoid, and composed of two bones, the posterior of which is somewhat dilated and fixed to the lateral dorsal shields.

"4. The ventral shields are the pubic bones; their posterior half is broadest, porous inferiorly; they are narrower before the middle, leaving a free lanceolate space between them, and are again a little widened anteriorly, where they join the humerus and urohyal." (*Günther*, iii, 532.) (Latin, *fistula*, a tube or pipe.)

a. Skin covered with dermal ossifications.

622—F. tabaccaria Linn.—*Trumpet-fish.*

Reddish brown above, variegated with numerous blue spots on the sides and back. Mouth slightly oblique, lower jaw the longer, overlapping the upper; snout much prolonged, tapering but little forward; its edges with fine serrations or none. Margin of orbit with sharp compressed points in front and behind. Mandible about 4 in snout; snout $3\frac{3}{4}$ in length of body. Head $2\frac{4}{5}$. D. 14; A. 13. Warm seas; occasional on our South Atlantic coast.

(Linn. Syst. Nat.; Günther, iii, 529.)

aa. Skin smooth, without dermal ossifications.

623. F. serrata Cuvier.

Grayish; sometimes with a series of blue spots along the back or sides; head silvery below. Form much as in the preceding, but head and body broader and more depressed; edges of snout more distinctly serrated, a foramen in the axil of pectoral. Snout $3\frac{3}{5}$ in length. Head $2\frac{2}{3}$. D. 14; A. 13. Warm seas; rare northward; perhaps the same as the preceding.

(Cuvier, Règne Anim. 1817; Günther, iii, 533.)

Family LXII.—AULOSTOMATIDÆ.

(*The Flute-mouths.*)

Body compressed, elongate, covered with small ctenoid scales. Lateral line continuous. Head long; mouth small, at the end of a long, compressed tube. Lower jaw prominent, with a barbel at the symphysis. Premaxillary feeble, not protractile; maxillary broad, triangular, with a supplemental bone. Teeth minute, in bands, on lower jaw and vomer. Branchiostegals 4. Gills 4, a slit behind the fourth. Pseudobranchiæ well developed. Gill-rakers obsolete. Gill-membranes separate, free from the isthmus. Air-bladder large. Spinous dorsal present, of 8–12 very slender free spines. Soft dorsal and anal rather long, similar, posterior. Caudal small, rhombic, the middle rays longest, but not produced into a filament. Ventrals abdominal, of six rays, all articulated. Pectorals broad, rounded, the space in front of them scaly. Two pyloric cœca. A single genus, with two species, found in tropical seas.

(*Fistularidæ* pt. genus *Aulostoma* Günther, iii, 535–538.)

191.—AULOSTOMA Lacépède.

(Lacépède, Hist. Nat. Poiss. v, 357, 1803: type *Fistularia chinensis* L.)

Characters of the genus included above. (*αυλος*, tube; *στόμα*, mouth.)

624. A. maculatum Val.

Olivaceous, with one or two series of brown or blue dots along each side of the back; another irregular series from the preoperculum along each side of the belly to the anal fin; three or four silvery lines on each side of abdomen, replaced on the head by irregular oblique streaks; anterior part of dorsal and anal with a horizontal black streak; caudal fin usually with two round black spots; ventral fins plain. D. X–23; A. 25; V. 6. (*Günther.*) Caribbean Sea, north to Southern Florida; probably identical with *A. chinense.*

(Valenc. in Cuv. Règne Animal, 1817: *Aulostoma coloratum* Müller & Trosch. Schomb. Hist. Barbad. 1848, 673: *Aulostoma coloratum* Günther, iii, 536.)

Family LXIII.—AULORHYNCHIDÆ.

Body elongate, nearly cylindrical, with a very slender, depressed caudal peduncle. Skin naked, with a few series of partly concealed plates. Mouth terminal, small, at the end of a tube which is about as long as the rest of the head; teeth very small; branchiostegals 4. Gill-membranes slightly connected, free from the isthmus. Dorsal fin with many small, low, free spines, each of which is depressible in a groove; soft dorsal short, elevated in front; anal similar to the second dorsal, preceded by a single spine; caudal fin small, forked. An oblong, naked area in front of the pectorals. Ventrals thoracic, but inserted somewhat behind pectorals, I, 4, or I, 5. Genus 1; species 2. Small fishes of the North Pacific, intermediate between the Sticklebacks and the Trumpet-fishes.

(*Aulorhynchidæ* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 233.)

a. Skin of head naked; ventrals I, 5; pectoral fins emarginate...Aulorhynchus, 192.

192.—AULORHYNCHUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 169: type *Aulorhynchus flavidus* Gill.)

Body very long and slender, almost cylindrical; caudal peduncle elongate, tapering, much depressed, especially posteriorly. Skin naked, with a series of small, rugose shields, one on each side of the lateral line, one on each side of the dorsal fin, and a double row on the lower edge of caudal peduncle. Lateral line present. Head not mailed. Mouth small, horizontal, at the end of a tube which is slightly longer than the rest of the head. Premaxillary bones much expanded, with long and slender processes; lower jaw projecting, with a flap at symphysis. Teeth in the jaws rather sharp, almost in one series; palate toothless. Dorsal spines numerous, entirely separate, equal and very short, the first inserted above the pectorals. Dorsal and anal fins posterior, nearly equal, oblong, elevated in front; caudal fin small, emarginate; pectoral fins emarginate, the upper and lower rays longest; ventrals not much behind pectorals, each with 1 spine and (4) 5 rays. (*αυλος*, a tube; *ρυγχος*, snout.)

a. Lateral shields imbedded, not spinous. (*Aulorhynchus.*)

625. A. flavidus Gill.

Tawny, with about 20 darker cross blotches on the back; minutely punctulate above; opercula and ante-pectoral region with bright golden or coppery lustre, bordered above by a blackish band. Gill-rakers slen-

der. Dorsal spines minute, much shorter than pupil. Caudal peduncle longer than head. Head 4; depth 16. D. XXV–9; A. I, 9; V. I, 5. Pacific coast, from Monterey northward; not rare.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 169: *Auliscops spinescens* Peters, Berlin Monatsbericht, 1866; Steind. Ichthyol. Beitr. v, 153.)

Family LXIV.—GASTEROSTEIDÆ.

(*The Sticklebacks.*)

Body elongate, somewhat compressed, tapering behind to a slender caudal peduncle. Head rather long, the anterior part not produced into a tube. Mouth moderate, with the cleft oblique, the lower jaw prominent. Teeth sharp, even, in a narrow band in each jaw; no teeth on vomer or palatines. Premaxillaries protractile. Preorbital rather broad; suborbital plate large, often covering the anterior part of the cheeks, forming a connection with the preopercle. Branchiostegals 3. Gill-membranes broadly joined, free from the isthmus, or not; gill-rakers moderate or rather long. Opercles unarmed. Skin naked or with vertically oblong bony plates; no true scales. Dorsal fin preceded by two or more free spines; anal similar to soft dorsal, with a single spine; ventral fins subabdominal, consisting of a stout spine and a rudimentary ray. Middle or sides of belly shielded by the innominate bones. Pectorals short, unusually far behind the gill-openings, preceded by a quadrate naked area, which is covered with shining skin. Caudal fin narrow, usually lunate. Air-bladder simple; a few pyloric cœca. Genera 3, *Gasterosteus*, *Apeltes*, and *Spinachia*. Species about 20. Small fishes inhabiting the fresh waters and arms of the sea in Northern Europe and America; noted for their pugnacity. They are exceedingly destructive to the spawn and fry of larger fishes.

"It is scarcely to be conceived what damage these little fishes do, and how greatly detrimental they are to the increase of all the fishes among which they live, for it is with the utmost industry, sagacity, and greediness that they seek out and destroy all the young fry that come their way." (*Günther.*) Most of the Sticklebacks build elaborate nests which the male fish defends with much spirit.

(*Gasterosteidæ* Günther, i, 1–7.)

a. Innominate bones joined, forming a triangular or lanceolate plate on the median line of the abdomen ..... GASTEROSTEUS, 193.

aa. Innominate bones widely separated, forming a bony ridge on each side, between which are the ventral fins ..... APELTES, 194.

193.—GASTEROSTEUS Linnæus.

Sticklebacks.

(Artedi; Linnæus, Syst. Nat. x, 1758: type *Gasterosteus aculeatus* L.)

Sticklebacks with the innominate bones coalescent on the median line of the belly, behind and between the ventral fins, forming a triangular or lanceolate plate. Tail slender, keeled or not. Skin naked or variously covered with bony plates. Dorsal spines 2–10 in number, variously developed. Species numerous. Fresh waters and shores of all northern regions. (γαστὴρ, belly; ὀστέον, bone.)

The group may be divided into the following sections, which are perhaps of generic value:

a. Gill-membranes posteriorly free from the isthmus.
  b. Dorsal spines 7–11, divergent (*Pygosteus* Brevoort).....*pungitius.*
  bb. Dorsal spines 5, in a right line (*Eucalia* Jordan).....*inconstans.*
aa. Gill-membranes not free from the isthmus; body more or less mailed (*Gasterosteus*).
microcephalus, biaculeatus, atkinsi, aculeatus.

a. Gill-membranes posteriorly free from the isthmus.
  b. Dorsal spines 7–11, divergent (*Pygosteus** Brevoort).

626. G. pungitius L.—*Nine-spined Stickleback.*

Olivaceous above, profusely punctulate, irregularly barred with darker, silvery below. Body very slender, somewhat compressed, tapering into the very long and slender caudal peduncle, which is much depressed and strongly keeled, broader than deep. No dermal bony plates; skeletal plates not all covered by skin. Post-pectoral plate well developed, striated. Head shortish, the snout rather blunt. Thoracic processes well developed, widely divergent, forming a U-shaped figure Dorsal spines moderate, the anterior diverging to the right or left at various angles, the posterior more nearly erect. Anal spine large, larger than the dorsal spines. Innominate bone feeble, lanceolate, not carinated, its edges raised. Ventral spines moderate, serrulate, their length more than one-third that of the head. Gill-rakers long and slender; gill-membranes free from the isthmus posteriorly. Head 4; depth 5–6. D. IX, I, 9; A. I, 8. L. 3 inches. Northern parts of Europe, Atlantic coasts of America, Great Lakes, and northward; a widely distributed species, found in both fresh and salt water.

(Linnæus, Syst. Nat.; Gunther, i, 6: *Gasterosteus occidentalis* Cuvier & Valenciennes, iv, 509: *Gasterosteus dekayi* Agassiz, Lake Superior, 311 (Massachusetts): *Gasterosteus*

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* Brevoort, MSS. Gill, Canadian Naturalist, August, 1865: type *Gasterosteus occidentalis* C. & V. = *Gasterosteus pungitius* L. (πυγὴ, rump; ὀστέον, bone.)

nebulosus Agassiz, Lake Superior, 1850, 310: *Gasterosteus concinnus* Richardson, Fauna Bor.-Amer. Fishes, 57 (Saskatchewan River and Great Bear Lake; D. VII–I, 9; A. I, 8): *Gasterosteus mainensis* Storer, Bost. Journ. Nat. Hist. i, 464 (Maine; D. VII–I, 9; A. I, 8). The two last perhaps represent a distinct subspecies, distinguished by the presence of 7 free dorsal spines.)

Subs. **brachypoda** Bean.

Similar to *pungitius*, but the ventral spines very short, their length a little less than one-third that of the head. D. X–I, 10; A. I, 10. Baffin's Bay to Alaska; abundant.

(Bean, Bull. U. S. Nat. Mus. xv, 129, 1879.)

bb. Dorsal spines about 5, in a right line (*Eucalia* * Jordan).

627. G. inconstans Kirt.—*Brook Stickleback.*

Males in spring jet black, tinged with red anteriorly; females and young olivaceous, mottled, and dotted with black. Body moderately elongate, little compressed, the caudal peduncle comparatively stout, not keeled. Skin smooth, entirely destitute of dermal plates, the skeletal plates covered by it. Innominate bone small, lanceolate, covered by the skin. Space in front of pectorals small; thoracic processes very slender and widely separated, covered by skin. Gill-membranes somewhat free posteriorly; gill-rakers short. Dorsal spines four or five, low, subequal, in a right line, a cartilaginous ridge running along the base of the fin; anal spine similar to dorsal spines; ventral spines short and sharp, serrated. Head $3\frac{1}{2}$; depth 4. D. IV–I, 10; A. I, 10. L. $2\frac{1}{2}$ inches. New York to Kansas and Greenland, in fresh waters only; abundant in the Great Lake region.

(Kirtland, Bost. Journ. Nat. Hist. iii. 273, 1841: *Gasterosteus micropus* Cope, Proc. Acad. Nat. Sci. Phila. 1865, 81: *Eucalia inconstans* Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 65: *Gasterosteus pygmæus* Agassiz, Lake Superior, 1850, 314, from Lake Superior; this is perhaps a distinct species, differing in the small number of fin-rays; D. III, I, 6; A. I, 6. *Eucalia inconstans* var. *cayuga* Jordan, Man. Vert. 1876, 249; specimens from Cayuga Lake, N. Y., with compressed and elevated body, slenderer tail, and higher spines: ? *Gasterosteus williamsoni*† Girard, U. S. Pac. R. R. Exp. and Surv. x, 94.)

aa. Gill-membranes not free from the isthmus; body more or less mailed. (*Gasterosteus.*)

c. Tail naked, not keeled. ‡

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* Jordan, Man. Vert. E. U. S. 1876, 248: type *Gasterosteus inconstans* Kirtland. (*εὐ*, well; *καλία*, nest.)

†Olivaceous brown, darker above; sides spotted with black; belly yellowish; head 3 in length; depth 5 in total length; eye $3\frac{1}{2}$ in length of head; tip of first dorsal spine not reaching the base of the second. D. III–I, 10; A. I, 7. (*Girard.*) Williamson's Pass, California. This form may differ from *G. inconstans* in the smaller number of dorsal spines.

‡Several recent writers have indicated their belief that the naked tailed sticklebacks are simple varieties of the ordinary species. This may be true, but we have not yet met with distinctly intermediate forms, either on the Atlantic or Pacific coast.

628. G. microcephalus Girard.

Olivaceous, silvery below; skin thickly punctulate; males blackish in spring, with coppery or golden lustre. Body short, deep, moderately compressed. Caudal peduncle rather deep and compressed. Posterior part of body unarmed. Processes from shoulder-girdle below widely diverging, leaving a triangular area on the breast; naked area in front of pectorals small. Ventral spines serrate, without distinct basal cusp. Spines of soft dorsal and anal small. Innominate bone lanceolate, twice as long as broad. Dorsal spines attached to bony plates, as in *G. aculeatus*. Head 3; depth $3\frac{3}{4}$. D. II–I, 11; A. I, 8. Lateral plates, 4 to 6. Pacific coast of the United States, ascending streams, abundant southward.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 133: *Gasterosteus plebeius* and *inopinatus* Girard, l. c. 147: *Gasterosteus pugetti*, Girard, U. S. Pac. R. R. Surv. Fish. 92.)

629. G. biaculeatus Shaw.

Closely related to the preceding, but rather larger; the innominate bone triangular, two-thirds as broad as long. Ventral spine with a distinct basal cusp on its outer edge. D. II–I, 12; A. I, 9. Northern Europe and United States from Cape Cod northward. Considered by most European writers as a variety of *G. aculeatus*.

(Shaw, Gen. Zool. iv, 608, 1805; Günther, i, 5: *Gasterosteus gymnurus* Cuvier, Règne Anim.: *Gasterosteus leiurus* Cuv. et Val. iv, 481: *Gasterosteus cuvieri* Girard, Bost. Journ. Nat. Hist. vi, 254; *Gasterosteus aculeatus trachurus* Goode & Bean, Bull. Essex Inst. 1879, 5: *Gasterosteus wheatlandi* Putnam, Proc. Essex Inst. 1867, 4.)

aa. Tail keeled, armed with plates.

630. G. atkinsii Bean.

Reddish, silvery below and with dark bands across the body. Body slender, as in *G. pungitius*. Lateral plates 15 in number, the posterior very thin, covered by skin. Tail keeled. Ventral spines long, nearly or quite reaching the vent; dorsal spines in a straight line. Head $3\frac{1}{3}$ in length; depth 5. D. II–I, 11; A. I, 8. (*Bean.*) Schoodic Lakes, Maine.

(Bean, Proc. U. S. Nat. Mus. 1879, 67.)

631. G. aculeatus L.—*Common Stickleback; Burnstickle.*

Dark greenish above; sides silvery, or yellow; membranes of ventrals often red. Head rather long. Caudal peduncle very slender, covered with plates similar to those on the body, and provided with a conspicuous keel. Processes from shoulder girdle below, covering most of the breast, leaving a narrow naked area between them. Opercle finely striate. Large rugose bony plates on each side of base of dorsal spines, the latter joined to them by a hinge and capable of being firmly set, like

the spines of cat-fish. Naked area in front of pectorals large. Pelvic bone lanceolate. Ventral spine with a basal cusp. Spines all serrate, those of anal and soft dorsal small. Head 3½; depth 4½. D. II–I, 13; A. I, 9. Lateral plates 33. L. 4 inches. North Atlantic; very abundant on both coasts.

(Linn. Syst. Nat. Günther, i, 4: *Gasterosteus noreboraccnsis* Cuv. & Val. iv, 502: *Gasterosteus biaculeatus* Storer, Hist. Fish. Mass. 40; *Gasterosteus biaculeatus et noveboracensis* DeKay, New York Fauna, Fish. 65, 66: *Gasterosteus niger* Cuv. & Val. iv, 504; *Gasterosteus trachurus* Cuv. & Val. iv, 481: *Gasterosteus bispinosus* Walbaum, Artedi Pisc. 1792, 450, the oldest American name.)

Subsp. **cataphractus** (Pallas) J. & G.—*Salmon-killer; Stickleback.*

Extremely similar, but more robust, the body and head a little shorter and deeper. Caudal keel very strong. San Francisco to Alaska and Kamtschatka; very abundant northward.

(*Gasteracanthus cataphractus* Pallas, Mém. Acad. Petersb. iii, 325, 1811: *Gasterosteus obolarius* Cuv. & Val. iv, 500: *Gasterosteus serratus* Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 47: *Gasterosteus intermedius* Girard, Proc. Ac. Nat. Sci. Phila. 1856, 135: *Gasterosteus insculptus* Rich. Last Arctic Voyage.)

194.—APELTES DeKay.

(DeKay, New York Fauna, Fish. 1842, 67, *nomen nudum*: type *Gasterosteus quadracus* Mitch.)

Body moderately elongate, somewhat compressed, the back elevated at the beginning of the soft dorsal fin, thence declining in nearly a straight line to the tip of the snout. Tail very slender, not keeled. No bony dermal plates; the skin naked. Innominate bones not joined on the median line but separated, forming a bony ridge on each side of the abdomen, below which the strong ventral spines are depressible. Chest mostly bony; bare area in front of pectorals small, but distinct Gill-rakers rather short. Gill-membranes attached to the isthmus, without free edge. Free dorsal spines 3, strong, the first the longest, directed to one side; the next two directed toward the other side at different angles; attached spine of dorsal and anal well developed; a bony ridge on each side of the spinous dorsal. (*a*, privative; πέλτη, shield.)

632. A. quadracus (Mitch.) Brevoort.

Brownish olive above, mottled with darker; silvery below; male almost black; ventrals with the membrane red in spring. Head 4 in length; depth 4. Caudal peduncle very long and slender, about 5 in length. D. III—I, 11; A. I, 8. L. 1½ to 2½ inches. Atlantic coast of the United States; very abundant northward.

(*Gasterosteus quadracus* Mitch. Trans. Lit. and Phil. Soc. i, 430, 1815: *Gasterosteus apeltes* Cuv. & Val. iv, 505; *Gasterosteus quadracus* Günther, i, 7.)

Order T.—ACANTHOPTERI.

(*The Spiny-rayed Fishes.*)

Cranium normal, symmetrical; the maxillary bone distinct from the premaxillary, which forms the border of the mouth. Bones of the mandible distinct. Gills normal, laminated, rarely reticulated. Gill-openings in advance of the pectorals. Opercular apparatus complete. Basal bones of pectorals not enlarged. Pharyngeals well developed, the third superior pharyngeal usually largest. Lower pharyngeals separate or united. Ventral fins variously placed, often wanting, normally thoracic and six-rayed, the first ray spinous. Anterior rays of dorsal and anal normally developed as spines, but often soft and articulate. Air-bladder, if present, without pneumatic duct. The most extensive of the orders of fishes, comprising a great variety of forms. (*ακανθα*, spine; *πτερον*, fin.)

(*Acanthopterygii, Pharyngognathi,* and *Anacanthini* Günther, i, ii, iii, iv, exclusive of various families. Orders *Percesoces, Fercomorphi,* and *Pharyngognathi* Cope, Trans. Amer. Phil. Soc. 1870, 456.)

ANALYSIS OF FAMILIES OF ACANTHOPTERI.

A. Ventral fins abdominal; dorsals two, well separated. (*Percesoces.*)
  B. Dentition strong; vertebræ 24 ..... Sphyrænidæ, 67.
  BB. Dentition feeble; vertebræ more than 24; carnivorous ..... Atherinidæ, 66.
  BBB. Dentition feeble; vertebræ 24; limnophagous ..... Mugilidæ, 65.
AA. Ventral fins, if present, thoracic or jugular.
  C. Ventral region without sucking-disk.
    D. Suborbital without bony stay.
      E. Ventral fins present, the rays in normal number,* I, 5.
        F. Lower pharyngeal bones separate (except in certain *Sciænidæ*); gills 4, a slit behind the last.
          G. Gill-membranes free from the isthmus.
            H. Spinous dorsal transformed into a lamellated sucking-disk, situated on the top of the head.
              Echeneididæ, 70.
            HH. Spinous dorsal not transformed into a sucking-disk.
              I. Scales small or obsolete, mostly cycloid; spinous dorsal comparatively little developed; caudal peduncle slender,† the fin widely forked.† (*Scombriform* fishes.)
          K. Vertebræ more than 24 or 25; no free anal spines.
            L. Spinous dorsal represented by free spines; caudal not forked; body elongate, fusiform.
              Elacatidæ, 71.

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* Except in certain *Stromateidæ, Acanthuridæ,* and *Icosteidæ.*

† Except in *Pomatomidæ, Elacatidæ,* and some *Stromateidæ.*

LL. Spinous dorsal well developed, depressible in a groove — Scales minute or wanting; premaxillaries non-protractile.....SCOMBRIDÆ, 74.

— — Scales of moderate size; premaxillaries protractile .....NOMEIDÆ, 76 (*b*).

LLL. Spinous dorsal little developed, or not distinguishable from the soft parts; no finlets.

M. Œsophagus without tooth-like process.CORYPHÆNIDÆ, 79.

MM. Œsophagus with tooth-like process...STROMATEIDÆ, 77.

KK. Vertebræ 25 (24–26); two free anal spines (sometimes obsolete).

N. Scales minute or obsolete, cycloid; tail widely forked.

CARANGIDÆ, 75.

NN. Scales small, weakly ctenoid; tail little forked.

POMATOMIDÆ, 76.

II. Scales well developed, mostly ctenoid;* caudal peduncle not especially slender.

O. Pectoral with the lower rays detached and filiform; two short, separated dorsal fins; head with muciferous system well developed.

POLYNEMIDÆ, 68.

OO. Pectoral fin entire.

P. Throat with two barbels; dorsals two; scales large.

MULLIDÆ, 90.

PP. Throat without barbels.

Q. Skull cavernous; anal spines 1 or 2; lateral line extending on the caudal fin; head scaly; no teeth on vomer.

SCIÆNIDÆ, 91.

QQ. Skull not especially cavernous.

R. Anal fin comparatively short, with less than 13† soft rays; vomer mostly with teeth. (*Perciform* fishes.)

S. Scales caducous; dorsal fins two, the first short; mouth very oblique.

APOGONIDÆ, 89.

SS. Scales adherent.

T. Anal spines 1 or 2; dorsal fins 2; pseudobranchiæ small or obsolete.

PERCIDÆ, 85.

TT. Anal spines 3‡ or more (rarely obsolete).

U. Pseudobranchiæ small, covered by the skin, or obsolete.

V. Vomerine teeth; lateral line present.

ELASSOMATIDÆ, 83 (*b*).

VV. Vomerine teeth none; lateral line obsolete .....CENTRARCHIDÆ, 84.

UU. Pseudobranchiæ well developed.

W. Maxillary not slipping under preorbital for its whole length.

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* Small or wanting in some *Uranoscopidæ*, *Trichodontidæ*, and *Icosteidæ*.

† Except in some *Sparidæ*, *Priacanthidæ*, *Centrarchidæ*, etc.

‡ Obsolete in some *Serranidæ*; more than three in some *Centrarchidæ*.

† Mouth nearly vertical; anal fin long; whole head closely scaly.
PRIACANTHIDÆ, 86 (*b*).

†† Mouth nearly horizontal; anal fin rather short. .... SERRANIDÆ, 86.

WW. Maxillary with its upper edge for its whole length slipping under the preorbital ..... SPARIDÆ, 88.

RR. Anal fin elongate; pseudobranchiæ present; spinous dorsal little developed.

X. Dorsal spines present; skeleton well ossified.

Y. Pectoral fins broad, procurrent forwards.

‡ Body scaly; slit behind fourth gill small; eyes superior.
URANOSCOPIDÆ, 103.

‡‡ Body naked; eyes lateral.
TRICHODONTIDÆ, 102.

YY. Pectoral fin narrow, not procurrent; body scaly.
LATILIDÆ, 101 (*b*).

XX. Dorsal spines obsolete; skeleton more or less cartilaginous.
ICOSTEIDÆ, 101.

GG. Gill-membranes united to the isthmus, restricting the gill-openings to the sides.

Z. Body not elevated; lateral line obsolete; spinous dorsal short and weak; inner rays of ventrals longest ..... GOBIIDÆ, 104.

ZZ. Body elevated; lateral line present; spinous dorsal well developed (*Chætodontiform* fishes.)

a. Teeth setiform, in many rows; vertical fins densely scaly; tail unarmed.

b. Dorsal fin divided.
EPHIPPIDÆ, 97.

bb. Dorsal fin continuous.
CHÆTODONTIDÆ, 98.

aa. Teeth incisor-like, in one row; tail with 1 or more spines on each side.
ACANTHURIDÆ, 99.

FF. Lower pharyngeals united. (*Pharyngognathi.*)

c. Nasal openings single on each side; scales mostly ctenoid.

d. Gills $3\frac{1}{2}$, last slit small or obsolete; pseudobranchiæ present; anal spines 2..... POMACENTRIDÆ, 96.

dd. Gills 4, a slit behind the last; pseudobranchiæ obsolete; anal spines 3 or more...CICHLIDÆ, 95.

cc. Nasal openings 2 on each side; anal spines 3; scales mostly cycloid.

e. Viviparous; dorsal fin with a scaly sheath; anal rays slender and numerous .....EMBIOTOCIDÆ, 93.

ee. Oviparous; anal rays rather few.

f. Teeth villiform; premaxillaries extremely protractile; gills 4, a slit behind last; pseudobranchiæ concealed.....GERRIDÆ, 92.

ff. Teeth not villiform; premaxillaries moderately protractile; gills $3\frac{1}{2}$; last slit obsolete; pseudobranchiæ well developed.LABRIDÆ, 94.

EE. Ventral fins, if present, with the rays in more or less than the normal number (I, 5).

h. Anal fin present.

i. Body compressed and elevated; the scales very small, or none.

j. Dorsal spines indistinct.

k. Ventral rays 4–6 .....BRAMIDÆ, 80.

kk. Ventral rays about 15.....LAMPRIDIDÆ, 78.

jj. Dorsal spines well developed; ventrals rays about I, 7.ZENIDÆ, 81.

ii. Body not specially elevated.

l. Ventrals thoracic (if present).

m. Ventrals with more than 5 soft rays; scales ctenoid; head armed.

n. Vent normal.....BERYCIDÆ, 82.

nn. Vent in front of ventrals; dorsal spines few.

APHREDODERIDÆ, 83.

mm. Ventrals few-rayed or wanting; scales small or wanting.

o. Upper jaw produced into a sword; dentition feeble; gills reticulated...XIPHIIDÆ, 72.

oo. Upper jaw not produced; dentition very strong; body elongate.....TRICHIURIDÆ, 73.

ll. Ventrals jugular (if present).

p. Pseudobranchiæ present. (*Blenniiform* fishes.)

q. Dorsal with many spines, sometimes entirely spinous.

BLENNIIDÆ, 113.

qq. Dorsal with few spines or none.

s. Gill-membranes united to the isthmus.

ZOARCIDÆ, 115.

ss. Gill-membranes broadly united, free from the isthmus; ventrals none.

CONGROGADIDÆ, 116.

sss. Gill-membranes separate, free from the isthmus.

t. Ventrals filamentous, at the throat; jaws with teeth ..... OPHIDIIDÆ, 118.

tt. Ventrals none; jaws toothless.

AMMODYTIDÆ, 69.

pp. Pseudobranchiæ obsolete.

u. Dorsal without distinct spinous part.

v. Vent at the throat; ventrals none.

FIERASFERIDÆ, 117.

vv. Vent posterior.

w. Scales cycloid; caudal fin present.

GADIDÆ, 120.

ww. Scales spinous, keeled; no caudal fin; the tail attenuate.

MACRURIDÆ, 121.

uu. Dorsal fin with a distinct spinous part, composed of a few spines; ventrals I, 2; gills 3, the gill-membranes broadly united to the isthmus.....BATRACHIDÆ, 112.

hh. Anal fin none; skeleton not ossified; caudal rudimentary, or not in the line of axis of body.
TRACHYPTERIDÆ, 100.

DD. Suborbital with bony stay. (*Cottiform* fishes.)
v. Head not mailed.
x. Slit behind fourth gill large; body evenly scaled .....CHIRIDÆ, 105.
xx. Slit behind fourth gill small or wanting.
y. Gill-membranes separate, free from isthmus; ventral fins normally formed, mostly I, 5.
SCORPÆNIDÆ, 106.
yy. Gill-membranes broadly joined, attached to the isthmus or not; ventral fins variously imperfect.
COTTIDÆ, 107.
vv. Head mailed, externally bony.
z. Ventrals few-rayed, close together; last gill-slit obsolete.
AGONIDÆ, 107 (*b*).
zz. Ventrals 1, 4, or I, 5, usually wide apart; last gill-slit large.
TRIGLIDÆ, 108.

CC. Breast with a sucking-disk.
a. Gill-openings narrow; spinous dorsal little developed; sucking-disk formed of the united ventral fins; pyloric cœca numerous; suborbital with a bony stay.
b. Skin smooth; vertebræ very numerous ..... LIPARIDIDÆ, 109.
bb. Skin tubercular; vertebræ rather few .....CYCLOPTERIDÆ, 110.
aa. Gill-openings wide; spinous dorsal wanting; sucking-disk between the ventral fins; no pyloric cœca; body naked...GOBIESOCIDÆ, 111.

FAMILY LXV.—MUGILIDÆ.

(*The Mullets.*)

Body oblong, more or less compressed, covered with rather large cycloid scales; no lateral line, but the furrows often deepened on the middle of each scale so as to form lateral streaks. Mouth small, terminal. Jaws with small teeth, or none; premaxillaries protractile. Gill-openings wide, the membranes separate, free from the isthmus. Branchiostegals 5 or 6. Gill-rakers long and slender. Gills 4, a slit behind fourth. Pseudobranchiæ large. Two short dorsal fins, well separated, the anterior with 4 stiff spines, the last one of which is much shorter than the others; second dorsal longer than the first, similar to anal;

anal spines 3, rapidly graduated; ventral fins abdominal, not far back, attached to the elongate coracoid bone, composed of one spine and five rays; caudal forked. Air-bladder large, simple. Intestinal canal long. Peritoneum usually black. Vertebræ 24. Genera 3; species 70–80; inhabiting the fresh waters and coasts of warm regions, feeding on organic matter contained in mud. A considerable indigestible portion of the latter is swallowed, and in order to prevent larger bodies from passing into the stomach, or substances from passing through the gill-openings, these fishes have the organs of the pharynx modified into a filtering apparatus. They take in a quantity of sand or mud, and after having worked it for some time between the pharyngeal bones, they eject the roughest and indigestible portion of it. The upper pharyngeals have a rather irregular form; they are slightly arched, the convexity being directed towards the pharyngeal cavity, tapering anteriorly, and broad posteriorly. They are coated with a thick, soft membrane, which reaches far beyond the margin of the bone, and is studded all over with minute horny cilia. Each branchial arch is provided with a series of long gill-rakers, which are laterally bent downwards, each series closely fitting to the sides of the adjoining arch; they constitute together a sieve admirably adapted to permit a transit for the water, retaining at the same time every solid substance in the cavity of the pharynx. (*Günther.*)

The *Mugilidæ*, *Atherinidæ*, *Sphyrænidæ*, and *Ophiocephalidæ* compose the group or suborder of *Percesoces*, thus characterized. Ventral fins abdominal; branchial arches well developed, the bones all present except the fourth superior branchihyal. Third superior pharyngeal much enlarged; lower pharyngeal distinct. Scales cycloid. Pectorals elevated, about on a level with the upper posterior angle of operculum; spinous dorsal usually present. (Latin, *Perca*, a perch; *Esox*, a pike—the group being intermediate in its position between the Percoids and the *Haplomi*.)

(*Mugilidæ* Günther, iii, 409, 467.)

* Jaws with a series of cilia, but without true teeth; part of the stomach muscular, gizzard-like..... MUGIL, 195.

195.—MUGIL Linnæus.

(*Mullets.*)

(Artedi; Linnæus, Syst. Nat.: type *Mugil cephalus* L.)

Body oblong, somewhat compressed, covered with large cycloid scales. Head large, bluntish, convex above, scaled. Mouth small. Jaws tooth-

less, usually provided with short, flexible cilia resembling teeth; lower jaw forming an angle at the symphysis. A portion of the stomach modified to form a muscular gizzard. Species very numerous, found in great schools near the shore in all warm regions. (Latin *Mugil*, the ancient name, from *mulgeo*, to suck.)

* Adipose eyelid well developed.

a. Scales medium (40–42 series); sides with dark stripes; anal rays III, 8.

633. M. mexicanus Steindachner.—*California Mullet; Macho.*

General form, coloration, and appearance of *M. albula*, the head rather longer, broader, and more depressed; interorbital space about half length of head. Anterior rays of dorsal and anal with small scales, the posterior part of the fin naked. Eye rather small; the adipose eyelid very thick. Bluish above; sides silvery, with dark stripes along the rows of scales. Head 4; depth 4. D. IV–I, 8; A. III, 8; Lat. l. 42. Pacific coast, chiefly south of Point Concepcion; abundant; very close to the next, of which it is probably a variety.

(Steindachner, Ichth. Beiträge, iii, 58, 1875.)

634. M. albula L.—*Striped Mullet.*

Body rather elongate, little compressed, subterete. Snout not broad, moderately depressed. Mouth moderate, the lips thin, the maxillary not nearly covered by the preorbital; angle made by the dentary bones obtuse, or nearly a right angle. Space at the chin between the mandibulary bones oblanceolate, acutish anteriorly. Scales comparatively small, a few on the dorsal and anal fins. Pectoral fins placed little above the axis of the body. Coloration dark-bluish above; sides silvery, with conspicuous darker lateral stripes; a dusky blotch at base of pectorals. Head $4\frac{1}{3}$; depth 4. D. IV–I, 8; A. III, 8; scales 42–13. Atlantic coast of United States; very abundant southward, where it is much valued as a food-fish.

(Linn. Syst. Nat.: *Mugil plumieri* Bloch, Ansl. Fisch. taf. 396: *Mugil lineatus* Cuv. & Val. xi, 96: *Mugil lineatus* Gthr. iii, 417: *Mugil berlandieri* Grd. U. S. Mex. Bound. Surv. 20, fig. 1—fig. 4 represents the young of *M. brasiliensis*.)

aa. Scales larger (38 series); sides without conspicuous dark stripes; anal rays III, 9.

635. M. brasiliensis Ag.—*White Mullet*; *Liza.*

Body oblong, rather compressed. Snout moderate. Mouth moderate; the maxillary mostly concealed under the preorbital; angle made by the dentaries about a right angle. Space at the chin between the mandibularies somewhat club-shaped. Scales comparatively large; soft

dorsal* and anal fins covered with small scales; pectoral fins mostly naked, inserted high. Coloration bluish above; the sides silvery, without conspicuous dark stripes, but with shining streaks along the rows of scales; a dusky blotch at the base of the pectoral; tips of caudal and soft dorsal blackish. Head 4; depth 4. D. IV–I, 8; A. III, 9; scales 38–12; vert. 11 + 13. Cape Cod to South America, and Lower California; abundant; on our Atlantic coast, usually reaching a smaller size than *Mugil albula*.

(Agassiz Spix. Pisc. Brazil, 234: *Mugil curema* and *Mugil petrosus* Cuv. & Val. xi, 87, 89; Günther, iii, 431: *Mugil lineatus* Storer, Hist. Fish. Mass.)

Family LXVI.—ATHERINIDÆ.

(*The Silversides.*)

Body rather elongate, somewhat compressed, covered with cycloid scales of moderate or small size. No lateral line; some scales often with rudimentary mucous tubes. Cleft of the mouth moderate. Teeth small, on jaws and sometimes on vomer and palatines, rarely wanting. Premaxillaries protractile or not. Opercular bones without spines or serrature. Gill-openings wide, the gill-membranes not connected, free from the isthmus. Gills 4, a slit behind the fourth. Pseudobranchiæ present. Gill-rakers usually long and slender. Branchiostegals 5 or 6. Dorsal fins 2, well separated, the first of 3–8 feeble, flexible spines, the second of soft rays. Anal with a weak spine, similar to the soft dorsal, but usually larger. Ventral fins small, abdominal, not far back, of 1 small spine and 5 soft rays. Pectorals moderate, inserted high. Air-bladder present. No pyloric cœca. Caudal and abdominal vertebræ very numerous. Carnivorous fishes, mostly of small size, living in great schools near the shore in temperate and tropical seas; a few species in fresh water; nearly all the species have a silvery band along the side. Genera about 8; species 50.

(*Atherinidæ* pt. Günther, iii, 391–407.)

a. Premaxillaries freely protractile (their skin not continuous with that of the forehead).

b. Premaxillary narrow, its edge nearly straight; teeth on vomer..ATHERINA, 196.

bb. Premaxillary broad posteriorly, its edge curved; no teeth on vomer.

c. Teeth none.....LEURESTHES, 197.

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*Dorsal and anal partly naked, pectoral wholly so in specimens from North Carolina; dorsal and anal densely scaly, pectoral mostly scaly in specimens from Acapulco, Mex., otherwise similar.

cc. Teeth in bands.
d. Jaws produced in a short beak.....LABIDESTHES, 198.
dd. Jaws not produced, the lower short.....MENIDIA, 199.
aa. Premaxillaries not truly protractile (skin of the premaxillaries mesially continuous with that of the forehead).
e. Teeth in villiform bands.....ATHERINOPSIS, 200.
ee. Teeth in a single series, each one bicuspid.....ATHERINOPS, 201.

196.—ATHERINA Linnæus.

Friars.

(Linnæus, Syst. Nat. xii, 1766: type *Atherina hepsetus* L.)

Body oblong, compressed. Mouth large, terminal, oblique; jaws about equal, their edges nearly straight; maxillary extending to the front of the eye. Premaxillaries narrow posteriorly, anteriorly protractile. Villiform teeth in bands on jaws, vomer, and palatines. Species numerous, mostly European. (*ἀθερίνη*, the ancient name, from *ἀθήρ*, a barb or spike, from the form of body or the numerous bones; possibly from *ἀθερίζειν*, to despise, from their diminutive size.)

636. A. carolina Cuv. & Val.

Very similar to the European *A. hepsetus*, but with the head smaller and the body slenderer. Depth $6\frac{3}{4}$ in total length, with caudal. D. VIII–I, 12; A. I, 15. L. 4 inches. South Carolina; not seen by recent writers. (*Cuv. & Val.*)

(Cuv. & Val. x, 445, 1835.)

637. A. veliana Goode & Bean.

Snout obtuse, top of head broad and very flat; cleft of mouth somewhat oblique; jaws equal anteriorly; maxillary extending beyond front of orbit. Teeth very small in the jaws and on the vomer. The silvery band occupies the third row of scales, its width less than half the diameter of the eye. Diameter of orbit contained twice in length of head, greater than interorbital width and more than twice the length of the snout. Spinous dorsal beginning behind the vertical from the tips of the ventral fins. Head $3\frac{1}{2}$ in length; depth $4\frac{2}{3}$. D. V–I, 9; A. I, 10; Lat. l. 36; L. transv. $6\frac{1}{2}$. (*Goode & Bean.*) Clear Water Harbor, Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. ii, 342, 1879.)

197.—LEURESTHES Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 29: type *Atherinopsis tenuis* Ayres.)

This genus agrees with *Menidia* in every respect, except that the teeth are obsolete. But one species is certainly known. (*λευρος*, smooth; *ἐσθίω*, to eat.)

638. L. tenuis (Ayres) J. & G.

Clear hyaline green, with the lateral silvery streak very distinct, wider than eye, on $1\frac{1}{2}$ rows of scales; edges of scales above bordered by

dark points. Scales small, smooth, and firm, closely imbricated, their edges crenate. Maxillary not reaching to pupil. Premaxillary very protractile, curved, its posterior portion broad. Lower jaw shorter than upper. First dorsal fin over front of anal, much nearer base of caudal than snout. Eye equal to snout. Head 4½; depth 5. D. V–I, 9; A. I, 22; Lat. l. 75. L. 5 inches. Coast of California; abundant in San Diego Bay.

(*Atherinopsis tenuis* Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 76.)

198.—LABIDESTHES Cope.

(Cope, Proc. Amer. Phil. Soc. Phila. 1870, 455: type *Chirostoma sicculum* Cope.)

This genus differs from *Menidia* chiefly in the prolongation of the jaws, both of which are produced into a short depressed beak. (λάβις, a pair of forceps; ἔσθίω, to eat.)

630. L. sicculus Cope.—*Brook Silverside; Skipjack.*

Pale olive-green, translucent; lateral silvery band very distinct, scarcely broader than pupil, bounded above by a dark line; back dotted with black. Body elongate, very slender, compressed. Head long, flattish above, narrow below. Snout slender, conic. Premaxillaries broad posteriorly, very protractile, produced forwards, the snout longer than the large eye. Edge of upper jaw strongly concave. Teeth very slender, mostly in one series, forming a narrow band in front. Scales small, thin, with entire edges. Spinous dorsal very small; soft dorsal short. Anal fin long; caudal forked; pectorals moderate. First dorsal inserted somewhat behind the vent. Head 4½; depth 6; eye 3½ in head. D. IV–I, 11; A. I, 23; Lat. l. 75. L. 3½ inches. Ponds and sluggish streams; Michigan to Iowa and Tennessee; locally abundant; a very graceful little fish.

(*Chirostoma sicculum* Cope, Proc. Acad. Nat. Sci. Phila. 1865, 81: *Labidesthes sicculus* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 40.)

199.—MENIDIA* Bonaparte.

Silversides.

(*Argyrea* DeKay: *Basilichthys* Grd.: *Labidesthes* Cope.)

(Bonaparte, Fauna Italica, about 1840: type *Atherina menidia* L.)

Body elongate, more or less compressed. Head oblong, compressed. Mouth small, the gape curved, very oblique, usually not reaching the eye;

* *Chirostoma* Swainson, Classin. Fishes, etc. 1839, 243 (= *Atherinoides* Bleeker = *Atherinichthys* Bleeker = *Heterognathus* Grd., all these nominal genera based on the same type, *Atherina humboldtiana* Cuv. & Val., from Mexico), is distinguished from *Menidia* by the very long and strong mandible which protrudes beyond the upper jaw. There are a few vomerine teeth, and the premaxillary is extremely protractile.

lower jaw short; maxillary slipping entirely under preorbital; jaws each with a band of simple, usually villiform teeth. Premaxillaries very freely protractile*, their spines comparatively long, nearly equal to the eye, extending backward beneath a fold of skin which connects the bases of the maxillaries; posterior part of premaxillaries broad. No teeth on vomer or palatines. Scales entire, or with the edges crenate or laciniate. Species numerous, of moderate or small size, some of them entering fresh waters. (*Menidia*, an old name of some small silvery fish, from $\mu\eta\nu\eta$, the moon.)

640. M. bosci (C. & V.) J. & G.

Clear transparent green; sides with a well-defined silvery band, $\frac{2}{3}$ diameter of the eye; back and chin with large, black dots. Eye large, $3\frac{1}{3}$ in head, a little longer than snout. Scales firm, their edges strongly crenate, those on the back laciniate. Upper jaw the longer. First dorsal very feeble, over the beginning of the anal, rather nearer the tip of the caudal than the snout. Distance from first to second dorsal $\frac{2}{3}$ length of head. Pectorals reaching ventrals, nearly as long as the head. Ventrals falling far short of the base of the first dorsal; second dorsal very short. Teeth short, even, forming a narrow villiform band. Head $4\frac{3}{4}$; depth $5\frac{1}{2}$. D. IV–I, 8; A. I, 22; scales 45–7. L. 5 inches. Atlantic Coast of the United States, chiefly southward; abundant.

(*Atherina menidia* Linn. Syst. Nat.: *Atherina bosci* Cuv. et Val. x, 465, 1835: *Atherina menidia* DeKay, New York Fauna, Fish. 142: *Atherinichthys menidia* et *notata* Günther, iii, 403.)

641. M. vagrans (Goode & Bean) J. & G.

Silvery streak occupying the lower two-thirds of the third and the upper two-thirds of the fourth series of scales. Eye 3 in head, as long as lower jaw, greater than snout and less than interorbital width. Premaxillaries freely protractile; teeth rather strong. Scales laciniate on the back, nearly entire laterally. First dorsal inserted opposite the space between the anal fin and the vent, nearer base of caudal than snout. Pectoral about as long as head. Caudal slightly forked, the lobes equal. Vertical fins excessively scaly. Head 5; depth $5\frac{3}{4}$ D. V–I, 7; A. I, 18; scales 48–7. L. 4 inches. Virginia to Gulf of Mexico.

(*Chirostoma vagrans* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 148.)

642. M. notata (Mitch.) J. & G.—*Silverside.*

Transparent green, with a lateral silvery band half the width of the

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*We have been able to verify this character on only a few of the foreign species. We are therefore uncertain whether the bulk of the species referred by Dr. Günther to "*Atherinichthys*" belong to *Menidia* or to *Atherinopsis*.

eye; scales above with spots along their edges, so that their outlines are clearly defined; chin speckled. Scales with entire edges. Eye large, 3½ in head, about as long as the snout. Jaws equal. First dorsal larger than in *M. bosci*, inserted in front of the anal, over the vent, about midway between snout and base of caudal. Distance between dorsals ⅔ length of head. Pectoral scarcely shorter than head, reaching past base of ventrals, which do not reach the vent or the front of the dorsal. Body slenderer, and more compressed than in *M. bosci*. Teeth in few series, some of them larger. Head 5; depth 6. D. IV–I, 8; A. I, 23; scales 46–10. L. 5 inches. Atlantic coast of United States, chiefly northward; abundant.

(*Atherina notata* Mitchill, Trans. Lit. and Phil. Soc. N. Y. 1814, 446: *Atherina notata* Dekay, New York Fauna, Fish. 141: *Atherina menidia* Cuv. et Val. x, 462: *Chirostoma notatum* of most recent writers.)

643. M. beryllina (Cope) J. & G.

Pale olive, with a silver band on 2½ rows of scales. Body stouter than usual. First dorsal far in advance of second, inserted over the vent, slightly nearer base of caudal than snout. Eye large, 3 in head. Mandible slightly projecting. Scales not described. Head 4¼; depth 6. D. V–I, 11; A. I, 18. L. 2½ inches. Potomac River. (*Cope.*)

(*Chirostoma beryllinum* Cope, Trans. Am. Phil. Soc. 1866, 403.)

644. M. brasiliensis (Quoy & Gaimard) J. & G.

Olivaceous, the silvery lateral stripe less than half the diameter of the eye; scales on back covered with dark dots. Scales all entire. Cleft of mouth reaching to nearly opposite eye. Jaws equal. Teeth not forming a close band. First dorsal inserted over the front of the anal, nearer the base of the caudal than the snout. Pectoral as long as the head, reaching well past root of ventrals, which reach the vent. Eye 3⅓ in head. Head 4; depth 5. D. IV–I, 9; A. I, 21; scales 40–8. L. 3 inches. Florida to Mexico and Brazil. Described from a specimen obtained in Saint John's River, Florida.

(? *Atherina brasiliensis* Quoy & Gaimard, Voy. Uran. Poiss. 332: *Atherina brasiliensis* Cuv. & Val. x, 467: *Atherinichthys brasiliensis* Günther, iii, 404.)

645. M. peninsulae (Goode & Bean) J. & G.

Silvery streak occupying the fourth and upper half of the fifth row of scales. Eye 3 to 3½ in head, about equal to the snout and the interorbital width. Mouth very protractile; lower jaw long, more than one-third the length of the head. Scales not described. First dorsal fin far in advance of the anal fin, in front of the vent, about midway

between base of caudal and snout. Caudal deeply forked, its lobes equal. Head 4; depth 5. D. V–I, 8; A. I, 15; scales 38–9. L. 4 inches. Florida. (*Goode & Bean.*)

(*Chirostoma peninsulæ* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 148.)

200.—ATHERINOPSIS Girard.

Pescadillo del Rey.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 134: type *Atherinopsis californiensis* Grd.)

This genus differs from *Menidia* in the non-protractility of the upper jaw. The spines of the premaxillaries are very short, much shorter than the eye, and they are covered by a skin which is continuous with that of the forehead, being only capable of such motion as is permitted by the extension of a fold of skin between the jaws and the frontal region. Species reaching a considerable size and having importance as food-fishes. (*αθερινη*, Atherina; *οψις*, appearance.)

646. A. californiensis Girard.—*California Smelt.*

Translucent greenish, a burnished lateral stripe which is rather plumbeous than silvery, some yellow on the opercles. Body elongate, little compressed. Maxillary narrow, not reaching to the eye, not slipping under the preorbital. Jaws even; teeth small, pointed, in narrow bands; inner series of upper jaw enlarged. Gill-rakers very long and slender. Scales crenate, somewhat rough, but not laciniate. First dorsal large, inserted in front of anal nearer base than snout; second dorsal inserted in front of middleof anal, which has a scaly sheath. Pectorals nearly as long as head, not reaching to ventrals, the latter half way to vent. Eye small, 5 in head. Head $4\frac{3}{4}$; depth 5. D. IX–I, 12; A. I, 23; scales 77–13. L. 18 inches. Pacific coast of United States; very abundant; a food-fish of considerable importance.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 134; Girard, U. S. Pac. R. R. Surv. Fish. x, 103: *Atherinichthys californiensis* Günther, iii, 406.)

201.—ATHERINOPS Steindachner.

(Steindachner, Ichth. Beiträge, iii, 61, 1875: type *Atherinopsis affinis* Ayres.)

Teeth *bifid*, arranged in a single row in each jaw. Otherwise as in *Atherinopsis*. One species known. (*αθερινη*, Atherina; *ωψ*, appearance.)

647. A. affinis (Ayres) Steindachner.—*Little Smelt.*

Clear hyaline green, a silvery lateral band, $1\frac{1}{2}$ scales wide, narrower than eye, bordered above by a purplish line. Back and sides thickly punctate. Iris and opercles with bright yellow. Maxillary not reaching

pupil. Lower jaw slightly shorter than upper. Teeth close-set, incisor-like, Y-shaped, the forks divergent; those in lower jaw largest and most movable. Eye large, not longer than snout. Spinous dorsal moderate, inserted over the vent, its origin midway between posterior angle of opercle and base of caudal. Pectoral about as long as the head, reaching ventrals, the ventrals not to vent. Body stouter than in related species. Scales firm, crenate. Peritoneum dark. Head 5; depth 4½. D. VI–I, 11; A. I, 22; Lat. l. 54. L. a foot. Pacific coast of United States, with *Atherinopsis californiensis*, and equally abundant.

(*Atherinopsis affinis* Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 73.)

Family LXVII—SPHYRÆNIDÆ.

(*The Barracudas.*)

Body elongate, subterete, covered with small cycloid scales. Head very long, pointed, pike-like, scaly above and on sides. Mouth horizontal, large. Jaws elongate, the lower considerably projecting; upper jaw non-protractile, its border formed by the premaxillaries, behind which are the broad maxillaries. Large, sharp teeth of unequal size on both jaws and on palatines; none on the vomer; usually a very strong tooth near the tip of the lower jaw. Opercular bones without spines or serratures. Gill-openings wide, the gill-membranes not united, free from the isthmus; gill-rakers very short or obsolete. Branchiostegals 7; gills 4, a slit behind the fourth. Psuedobranchiæ well developed. Air-bladder large, bifurcate anteriorly; many pyloric cœca. Lateral line well developed, straight. Pectoral fins short, placed in or below the line of the axis of the body; ventrals I, 5, abdominal, in advance of the middle of the body; first dorsal over ventrals, of 5 rather stout spines; second dorsal remote from first dorsal, similar to anal and opposite to it; caudal fin forked. Vertebræ 24. A single genus of about 15 species; voracious pike-like fishes, inhabiting nearly all temperate and tropical seas.

(*Sphyrænidæ* Günther, ii, 334–341.)

202.—SPHYRÆNA Bloch.

Barracudas.

(Artedi; Bloch, Ichth.: type *Esox sphyræna* Gmel.)

Characters of the genus included above. (σφύραινα, the ancient name, "hammer fish," from σφῦρᾰ, a dart.)

* Pectorals not reaching nearly to front of dorsal.

648. S. argentea Grd.—*Barracuda.*

Brownish, with bluish lustre; belly white, scarcely silvery. Body elongate, little compressed. Lower jaw much produced, fleshy at tip. Eye 10 in head. Maxillary not reaching front of eye; about 3 in head. Teeth moderate, little compressed. Spinous dorsal inserted a little nearer snout than caudal, just in front of ventrals, well behind the end of the pectorals, which are a little longer than the ventrals and less than one-tenth the total length. Scales very small. Head $3\frac{3}{4}$; depth $7\frac{1}{2}$. D. V–I, 9; A. I, 8; scales in 238 series, 166 in the lateral line. L. 3 feet. Pacific coast, from San Francisco southward; abundant; an important food-fish.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 144; Steindachner, Ichth. Beitr. vii, 1; Günther, ii, 338.)

649. S. spet (Haüy) Lacépède.—*Barracuda.*

Olivaceous, silvery below; young with dusky blotches across the back and along the lateral line. Body rather slender, with rather large scales. Maxillary not reaching eye; $2\frac{1}{2}$ in head. Teeth moderate. First dorsal inserted slightly in front of base of ventrals, nearly midway between snout and base of caudal, much behind the end of the pectorals. Space between dorsals about one-sixth of the total length. Pectorals about as long as ventrals, 12 in total length. Eye 8 in head. Lower jaw with a fleshy tip. Head 3; depth 8. D. V–I, 9; A. I, 9; Lat. l. 130–150. L. 24 inches. Cape Cod to the Mediterranean (the common European species); not rare on our coast.

(*Esox spet* Haüy, Encyclop. Method. Poiss, iii, 7187: *Sphyræna vulgaris* Günther, ii, 334: *Esox sphyræna* Gmel. Syst. Nat. 1389: Lacépède, Hist. Nat. Poiss, v, 326: ? *Sphyræna borealis* DeKay, New York Fauna, Fish. 39: *Sphyræna borealis* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 146. More than one species has been confounded under the above names.)

** Pectoral reaching front of spinous dorsal.

650. S. guaguancho Cuv. & Val.

Origin of first dorsal fin in front of the middle of the body, more or less in advance of the tip of the pectorals. Ventrals in front of the dorsal. Fifth dorsal spine midway between tip of snout and base of caudal. Pectoral as long as postorbital part of head. Interspace between dorsals $5\frac{1}{2}$ in length. Eye 6 in head. Opercle with 2 points. Head $3\frac{1}{4}$; depth 7. D. V–I, 9; A. II, 8; scales 14–110–17. L. 18 inches. Cape Cod to Florida and Cuba. (*Goode & Bean.*)

(Cuv. & Val. iii, 342; Goode & Bean, Proc. U. S. Nat. Mus. 1879, 146: *Sphyræna guaguanche* Poey, Memorias, ii, 166.)

651. S. picuda Bloch & Schneider.—*Picuda; Barracuda.*

Origin of first dorsal opposite ventrals, far in advance of the middle of the body, at the tip of the pectorals. Interspace between dorsals one-fifth of total length. Pectoral fins one-eleventh of total length. Scales large. Head $3\frac{1}{2}$ in total length; depth $7\frac{1}{4}$. D. V–I, 9; A. I, 9; scales 9–83–15. Vertebræ 12 + 12. L. $3\frac{1}{2}$ feet. (*Günther.*) West Indies, north to Florida.

(Bloch & Schneider, 1801, 110: *Sphyræna barracuda* Cuv. & Val. iii, 343; Günther, ii, 336; Goode & Bean, Proc. U. S. Nat. Mus. 1879, 146.)

Family LXVIII.—POLYNEMIDÆ.

(*The Thread-fins.*)

Body oblong, compressed, covered with rather large scales, which are feebly ciliated or smooth; lateral line continuous, extending on the caudal fin. Head entirely scaly; snout conic, projecting over the horizontal mouth, which is rather large, the maxillary extending to beyond the eye. Eye lateral, anterior, large, with a large adipose eyelid. Villiform teeth on jaws and palatines and usually on vomer also. Pseudobranchiæ concealed. Branchiostegals 7. Gill-membranes separate, free from isthmus. Gills 4, a slit behind fourth. Dorsal fins 2, well separated, as in the *Percesoces*, the first of about 7 feeble but rather high spines, the second rather larger, of soft rays. Anal fin similar to the soft dorsal, sometimes larger; caudal fin widely forked; second dorsal, anal, and caudal fins usually covered with small scales; ventrals I, 5, thoracic, but placed well behind the pectorals; pectoral fins moderate, placed low, divided into two parts, the lower and anterior portion composed of several filiform articulated appendages, free from each other, organs of touch. Bones of skull with a well-developed muciferous system, as in *Sciænidæ*. Basis cranii double, with tube; post-temporal bifurcate; scapula with median foramen; superior pharyngeal bones 4, third largest, narrow, directed forward. Basal pectoral bones divided; two normal, supporting the fin, one longitudinal without rays, and one a plate on the coracoid, supporting elongate rays. Stomach cœcal, with a few pyloric appendages. Air-bladder various, sometimes wanting. Vertebræ 24. Genera 3; species 25. Tropical seas. A singular group, in some respects intermediate between *Sciænidæ* and *Mugilidæ*, but not closely related to any other of our fishes. Most of them are valued as food fishes.

(*Polynemidæ* Günther, ii, 319–333.)

a. Vomer with teeth; preopercle serrate; anal fin not much larger than second dorsal .... Polynemus, 203.

203.—POLYNEMUS Linnæus.

(*Trichidion* Klein; Gill.)

(Linn. Syst. Nat.: type *Polynemus paradisæus* Linn.)

Teeth in villiform bands on both jaws, vomer, palatines, and pterygoids. Preopercle sharply serrated on its posterior margin, its angle with a scaly flap. Scales rather small, finely ctenoid. First dorsal with 7 or 8 feeble, rather high spines, the first and last short. Soft dorsal and anal fins about equal to each other; pectoral filaments 3 to 9. Pyloric cœca in great number. Species numerous in warm seas. ($\pi o \lambda \upsilon \varsigma$, many; $\nu \tilde{\eta} \mu \alpha$, thread; from the numerous pectoral appendages.)

* Pectoral appendages 7.

649. P. plumieri (Lac.) Gthr.

Silvery; pectoral fins black. Maxillary extending backwards past eye to base of mandible. Pectoral filaments about as long as the fin. Spinous dorsal high; soft dorsal similar to anal, its last ray produced. Head $3\frac{1}{2}$ in length; depth about $3\frac{1}{2}$. D. VII–I, 12; A. II, 13; scales 6–58–10. West Indies; occasional on our South Atlantic coast.

(*Polydactylus plumieri* Lac. v, pl. 14, f. 3; Günther, ii, 321: *Trichidion plumieri* Gill, Proc. Ac. Nat. Sci. Phila. 1861, 279.)

** Pectoral appendages 8.

650. P. octofilis (Gill) J. & G.

Silvery, vertical fins punctulated with black; pectoral fins black. Pectoral filaments short, reaching middle of interspace between dorsal fins. Maxillary $2\frac{2}{3}$ in length of head. Eyes large, about 4 in head. Head $3\frac{1}{2}$ in length; depth about $3\frac{1}{3}$. D. VIII–I, 11; A. II, 14; scales 6–60–10. New York; one specimen known.

(*Trichidion octofilis* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 280.)

651. P. octonemus Grd.

Brownish, sides silvery; fins white. Pectoral filaments very long, the longest reaching past the front of the anal fin. Eye 4 in head. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. VIII–I, 12; A. II, 13; scales 6–61–10. (*Girard.*) Florida to Texas.

(Girard, Proc. Acad. Nat. Sci. Phila. 1858, 167; Günther, ii, 320: *Trichidion octonemus* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 286.)

Family LXIX.—AMMODYTIDÆ.

The Sand Launces.

Body elongate, compressed, covered with small cycloid scales. Head long. Mouth rather large, nearly horizontal, the lower jaw considerably projecting, the symphysis produced. No teeth in jaws. Gill-openings very wide; gill-membranes not united, free from the isthmus. Branchiostegals 6 to 8. Pseudobranchiæ large, lamellate. Gill-rakers long and slender; gills 4, a slit behind the fourth. Opercles well developed, without spines or serratures. Eye moderate. Premaxillaries very protractile. Maxillaries long and slender. Lateral line running along side of back. Spinous dorsal absent (or represented by a few weak spines); soft dorsal very long and low, fragile, extending from behind the head to near the base of caudal. Caudal fin small, forked. Anal similar to dorsal, but smaller. Vent somewhat behind middle of body. No ventral fins. Pectoral fins inserted low. No air-bladder. Pyloric cœca usually 1. Genera 4, species 8. Small fishes swimming in large schools and often burying themselves in the sand. Found along the coasts of northern regions.

(*Ophidiidæ* group *Ammodytina* Günther, iv, 384–388.)

* Body with many transverse, oblique folds; a longitudinal fold of skin along sides of belly; vomer unarmed.

a. Dorsal fin without spines.... .....AMMODYTES, 204.

aa. Dorsal fin preceded by 7 small free spines.....ARGYROTÆNIA, 205.

204.—AMMODYTES Linnæus.

Sand Launces.

(Artedi; Linn. Syst. Nat.: type *Ammodytes tobianus* L.)

Body elongate, lanceolate, the skin with many transverse folds running obliquely downward and backward, the small cycloid scales mostly placed in cross-series between them. Lateral line concurrent with the back. A fold of the skin along each side of the belly. Vomer not armed with a bicuspid tooth. Color silvery. Vertebræ 63. (*ἄμμος*, sand; *δύω*, to dive.)

652. A. americanus DeKay.—*Sand Launce; Sand Eel; Lant.*

Olivaceous above, silvery below; sides with a steel-blue stripe. Pectoral fins much longer than snout, reaching front of dorsal. Lateral folds 125–130. Depth equal to length of mandible, which is $2\frac{1}{3}$ in head.

Head $4\frac{3}{4}$; depth about 10. D. 60; A. 28. Newfoundland to Cape Hatteras, abundant. Scarcely different from *A. tobianus* of Europe.

(DeKay, New York Fauna, Fish. 1842, 317; Günther, iv, 386; Storer, Hist. Fish. Mass.)

653. A. personatus Grd.—*Sand Launce.*

Clear hyaline green; sides silvery. Pectoral fin half length of head, reaching past the front of the dorsal. Lateral folds 130–150. Head $4\frac{1}{2}$; depth 9. Eye 2 in snout, 6 in head. D. 54; A. 24. L. 6 inches. Monterey to Alaska, very abundant; probably also a variety of *A. tobianus.*

(Girard, Proc. Ac. Nat. Sci. Phila. 1856, 137; Günther, iv, 387.)

654. A. alascanus Cope.

Dorsal inserted above middle of pectoral. Maxillary reaching front of orbit. Mandible less than depth of body. Head $4\frac{1}{2}$; depth 9. Eye 2 in snout, 6 in head. Lateral folds 182. D. 62; A. 31. L. 6 inches. Sitka, Alaska. (*Cope.*)

(Cope, Proc. Am. Phil. Soc. 1873. Probably also a form of *A. tobianus.*)

655. A. dubius Reinh.

Skin with about 150 very distinct folds. Dorsal fin inserted over posterior third of pectoral. Head 6; depth equalling length of mandible, $2\frac{1}{3}$ in length of head. D. 65; A. 34. Cape Cod to Greenland. (*Günther.*)

(Reinhardt, Dansk. Vidensk. Selsk. Afhandl. 1838, 132; Günther, iv, 387.)

205.—ARGYROTÆNIA Gill.

(Gill, Cat. Fish. East Coast N. Amer. 1861, 40 (not characterized): type *Ammodytes vittatus* DeKay.)

This genus is supposed to differ from *Ammodytes* in the presence of a rudimentary spinous dorsal, composed of about 7 minute free spines. (*αργυρος*, silver; *ταινία*, ribbon.)

656. A. vittata (DeKay) Gill.

Greenish olive above, with a broad silvery band along the sides, which is margined above with blackish; silvery below. Body oblong, somewhat compressed, slender. Head small and pointed, flattened and grooved above, compressed beneath. Eyes large. Snout terminating in a bifid tip. Mouth rather large, protractile, toothless. Lower jaw longest. D. VII, 54; A. 28. Sag Harbor, New York. (*DeKay.*) It has not been seen since its description by DeKay, and its existence is extremely doubtful.

(*Ammodytes vittatus* DeKay, New York Fauna, Fish. 1842, 318.)

Family LXX.—ECHENEIDIDÆ.

(*The Remoras.*)

Body fusiform, elongate, covered with minute, cycloid scales. Mouth wide, with villiform teeth on jaws, vomer, palatines, and usually on tongue. Premaxillaries not protractile. Lower jaw projecting beyond upper. Spinous dorsal modified into a sucking-disk, which is placed on the top of the head and neck, and is composed of a double series of transverse, movable, cartilaginous plates, serrated on their posterior or free edges. By means of this disk these fishes attach themselves to other fishes or to floating objects, and are carried for great distances in the sea. Opercles unarmed. Pectoral fins placed high; ventral fins present, thoracic, and close together—I, 5; dorsal and anal fins long, without spines, opposite each other; caudal fin emarginate or rounded. Branchiostegals 7. Gills 4, a slit behind the fourth; gill-rakers short; gill-membranes not united, free from the isthmus. Pseudobranchiæ obsolete. Several pyloric appendages. No air-bladder. No finlets. No caudal keel. Vertebræ more than 10 + 14. Genera 2; species about 10, found in all seas, all having a very wide range.

(*Scombridæ* part: genus *Echeneis* Günther, ii, 376–385.)

a. Rays of pectorals normal ..... Echeneis, 206.
aa. Rays of pectoral fins stiff, broad, osseous ..... Rhombochirus, 207.

206.—ECHENEIS Linnæus.

(Artedi; Linn. Syst. Nat.: type *Echeneis naucrates* L.)

Pectoral rays soft and flexible. Characters otherwise included above.

(ἐχενῆις, an ancient name, from ἔχω, to hold back; ναυς, a ship.)

a. Body very slender; vertebræ 14 + 16. (*Echeneis.*)

657. E. naucrates L.—*Pegador.*

Brownish; belly dark like the back, as usual in this family; sides with a broad stripe of darker edged with whitish, extending through eye to snout; caudal black, its outer angles whitish; pectorals and ventrals black, sometimes bordered with pale; dorsal and anal broadly edged with white anteriorly. Body elongate, subterete, slender. Disk long. Dorsal and anal fins longer than the disk; inner rays of ventral fins narrowly adnate to the abdomen; caudal becoming emarginate with age. Vertebræ 14 + 16. Vertical fins low; pectorals $\frac{3}{4}$ length of head, rather long and acute. Lower jaw projecting, with the tip flexible.

Maxillary barely reaching vertical from nostril. Head $5\frac{1}{2}$ in length; disk $3\frac{2}{3}$; width between pectorals about $7\frac{1}{2}$. D. XXI–XXV—32–41; A. 34 (32–38). In all warm seas, north to Cape Cod and San Francisco.

(Linn. Syst. Nat.; Günther, ii, 384: *Leptecheneis naucrates* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 60. *Echeneis naucrateoides* Zuieuw, Nova. Acta. Acad. Sci. Imp. Petropol. iv, 279, *Leptecheneis naucrateoides* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 61, *Echeneis albicauda* Mitch. Amer. Monthly Mag. ii, 244. *Echeneis lineata* Holbr. Ichth S. C. 1860, 102, and *Echeneis holbrooki*, Günther, ii, 382, are names applied to specimens with the disk comparatively long, but with only 21 laminæ.)

aa. Body rather robust; vertebræ 12 + 15. (*Remora** Gill.)
b. Dorsal rays about XVIII–23.

658. E. remora L.—*Remora.*

Uniform dark brown. Body and tail comparatively robust, the latter compressed. Pectoral fins rounded, short, and broad, their rays soft and flexible; ventral fins adnate to the abdomen for more than half the length of their inner edge. Tip of lower jaw not produced into a flap. Vertebræ 12 + 15. Head broad, depressed Disk longer than the dorsal or anal fin. Maxillary scarcely reaching front of orbit. Caudal lunate; vertical fins rather high; pectoral $\frac{3}{5}$ length of head. Head 4; disk $2\frac{3}{4}$; width between pectorals $5\frac{1}{4}$. D. XVIII—23; A. 25. Warm seas, north to New York and San Francisco, usually found attached to large sharks.

(*Echeneis remora* L. Syst. Nat.: *Echeneis jacobæa* Lowe, Proc. Zoöl. Soc. London, 1839, 89: *Echeneis remora* Günther, ii, 378: *Remora jacobæa* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 239.)

aa. Dorsal rays about XVI–30. (*Remoropsis* Gill.)

659. E. brachyptera Lowe.

Light brown, darker below; fins paler; body robust, the greatest depth nearly twice the length of the short pectoral fins; disk shorter than base of dorsal, rather broad; upper jaw angular. Caudal nearly truncate. Head nearly 4; width between pectorals $6\frac{1}{2}$. D. XVI—30; A. 26. Warm seas, north to Massachusetts.

(*Echeneis brachyptera* Lowe, Proc. Zoöl. Soc. Lond. 1839, 89: *Echeneis quatuordecemlaminatus* Storer, Hist. Fish. Mass. 406: *Echeneis brachyptera* Günther, ii, 378: *Remoropsis brachypterus* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 60.)

207.—RHOMBOCHIRUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 88: type *Echeneis osteochir* Cuv.)

This genus agrees with *Remora* in every respect excepting the structure of the pectoral fins. These are short and broad, rhombic in outline,

*Gill. Proc. Acad. Nat. Sci. Phila. 1862, 239: type *Echeneis remora* L. (*Remora*, an ancient name, "holding back.")

the rays all flat, broad and stiff, being partially ossified, although showing the usual articulation; upper rays of pectoral broader than the others. One species known. (*δόμβος*, rhomb; *χέιρ*, hand.)

660. R. osteochir (Cuvier) Gill.

Light brown; underside of head, ventral line, part of ventrals and a spot on pectorals pale. Mouth very small, maxillary not nearly reaching to the line of the orbit. Disk very large, broader and rougher than in *Echeneis remora*, extending forwards beyond the tip of the snout. Caudal fin emarginate, with rounded angles. Head $4\frac{2}{3}$ in length; disk $2\frac{1}{4}$; width between pectorals 5. D. XVIII—21; A. 20; P. 20. West Indies, north to Cape Cod; parasitic on species of *Tetrapturus*.

(*Echeneis osteochir* Cuvier, Règne Anim: *Echeneis osteochir* Günther, ii, 381: *Echeneis tetrapturorum* Poey, Memorias, ii, 256.)

Family LXXI.—ELACATIDÆ.

(*The Crab-eaters.*)

Body elongated, fusiform, subcylindrical, covered with very small, smooth scales. Head rather broad, low, pike-like. Mouth rather wide, nearly horizontal, the maxillary about reaching front of eye; both jaws, vomer, palatines, and tongue with bands of short, sharp teeth; lower jaw longest. Premaxillaries not protractile. First dorsal represented by about eight low, stout, equal, free spines, each spine depressible in a groove; soft dorsal long and rather low, somewhat falcate, similar to and nearly opposite the anal; two weak anal spines, one of them free from the fin; ventrals thoracic, I, 5; caudal fin forked; no caudal keel; no finlets; no sucking-disk; no air-bladder. Branchiostegals 7. Pyloric cœca branched. Vertebræ more than 10 + 14. A single genus with probably but one species, a large, strong, voracious fish, found in all warm seas. (*Scombridæ* part, genus *Elacate*, Günther, ii, 375.)

208.—ELACATE Cuvier.

(Cuvier, Règne Anim. ed. 2d, 1829: type *Elacate malabarica* Cuv. = *Gasterosteus canadus* L.)

Characters of the genus included above. (*ἠλακάτη*, a spindle or an arrow, from the form of the body.)

661. E. canada (Linn.) Gill.—*Crab-cater; Cobia.*

Olive brown, sides with a distinct broad band of darker, and a less distinct band above and below it; below silvery. Head much depressed. Mouth moderate, the short maxillary reaching front of orbit. Pectorals broad and falcate; caudal deeply emarginate, the upper lobe slightly

the longer. Lateral line wavy and irregular, descending posteriorly. Head $4\frac{1}{4}$ in length; depth $5\frac{2}{3}$. D. VIII–I, 26; A. II, 25. L. 5 feet. In all warm seas, occasional on our Atlantic coast in summer.

(*Gasterosteus canadus* Linn. Syst. Nat.: *Elacate atlanticus* Cuv. & Val. viii, 334: *Elacate nigra* Günther, ii, 375; Holbrook, Ichth. S. Car. 97.)

Family LXXII.—XIPHIIDÆ.

(*The Sword-fishes.*)

Scombroid fishes of great size, with the body elongated, naked or covered with rough rudimentary scales, and the upper jaw very much prolonged, forming a "sword," which is composed of the consolidated vomer, ethmoid and premaxillaries. Teeth small and rudimentary, or wanting. Dorsal fin long, usually divided in the adult, continuous in the young, without differentiated spinous part, the posterior portion much smaller than the anterior. Anal fin similarly divided in the adult. Caudal peduncle slender, keeled. Ventral fins thoracic, incomplete or entirely wanting. Caudal fin widely forked in the adult. Gills of peculiar structure, the laminæ of each arch joined into one plate by reticulations. Gills 4, a slit behind fourth; gill-membranes separate, free from isthmus. Pseudobranchiæ present. Branchiostegals 7. Air-bladder present. Pyloric cœca very numerous. Very young individuals differing much from the adults; the fins high, both jaws prolonged into a beak, and the head armed with long spines. Genera 3; species about 5; powerful fishes, inhabiting the open seas, most of them valued as food. (*Xiphiidæ* Günther, ii, 511–514.)

a. Ventral fins entirely wanting; teeth none. (*Xiphiinæ*).....Xiphias, 209.
aa. Ventral fins present; teeth small. (*Histiophorinæ.*)
b. Ventral rays united into one; dorsal fin low .....Tetrapturus, 210.
bb. Ventral rays three; dorsal very high .....Histiophorus, 211.

209.—XIPHIAS Linnæus.

Sword-fishes.

(Linn. Syst. Nat.: type *Xiphias gladius* L.)

Sword-fishes without teeth and without ventral fins. Body somewhat compressed. Dorsal fins 2, the anterior beginning opposite the gill-openings, falcate and elevated, its height rather less than that of the body; second dorsal very small, on the tail, opposite the small second anal. In the young, teeth are present and the two dorsal fins are connected, the fin being elevated as in the species of *Histiophorus*. First anal similar to first dorsal, but smaller, less falcate, and far behind it;

pectoral fins moderate, falcate. Skin naked, more or less rough, especially in the young, which have rudimentary scales. Sword flattened. Caudal keel single. Intestines long, sinuous. Air-bladder simple. Pelvic arch obsolete. Fishes of great size, reaching a weight of 300 to 400 pounds, the flesh valued for food. (ξιφίας, the ancient name of *Xiphias gladius*, from ξίφος, a sword.)

662. X. gladius L.—*Common Sword-fish.*

Very dark bluish above, dusky below; "sword" almost black above, below lighter. Cleft of mouth extending beyond eye. Head about $2\frac{1}{4}$; depth about $5\frac{1}{2}$. Snout 3 in length. D. 40–4; A. 18–14. Vert. 14 + 12. Atlantic Ocean, on both coasts; also in the Pacific, north to the Santa Barbara islands.

(Linn. Syst. Nat.; Günther, ii, 511; Storer, Fish. Mass. 1867, 71.

210.—TETRAPTURUS Rafinesque.

Spear Fishes.

(Rafinesque, Indice d'Ittiol. Sicil. 1810, 30: type *Tetrapturus belone* Raf. of the Mediterranean.)

Sword-fishes with small teeth in the jaws and on the palatines, with the ventral fins represented each by a single spine, and with the dorsal fin not greatly elevated, divided in the adult, its height not greater than the depth of the body. Body much compressed. Skin with rudimentary embedded scales; sword rounded; caudal keel double. Air-bladder sacculated. Vertebræ 12 + 12. Intestine short, straight. (τετρα, four; πτερὸν, wing; σὐρὰ, tail, from the wing-like caudal keels.)

663. T. albidus Poey.—*Bill-fish; Spear-fish; Aguja Blanca.*

Dark blue above; whitish beneath; fins dark blue. Nape elevated, the greatest depth of the body opposite the opercle. Eye midway between opercle and tip of lower jaw. Dorsal inserted in front of base of pectorals. Caudal forked at an angle of 70 to 80 degrees. Head (to end of upper jaw) $2\frac{2}{5}$; depth 7–8. Length of caudal lobes $4\frac{1}{2}$. D. III, 39–6; A. II, 13–6. Length 7 to 8 feet. (*Poey.*) Cape Cod to West Indies; not rare on our coast.

(Poey, Mem. ii, 237: ? *Tetrapturus belone* Raf. *Histiophorus belone* Günther, ii, 513.)

664. T. amplus Poey.—*Aguja de Casta.*

Color dark blue; paler below, with bluish cross streaks. Body stouter, more convex at the nape, the greatest depth being behind the opercle. Caudal forked at anangle of 90 to 100 degrees. Dorsal inserted

rather behind base of pectorals. Head $2\frac{3}{5}$; depth 5. Length of caudal lobes $3\frac{1}{3}$. D. III, 38–7; A. II, 13–7. Length 8 feet. (*Poey.*) West Indies, north to Florida; perhaps a form of the preceding.

(Poey, Memorias, ii, 243.)

211.—HISTIOPHORUS Lacépède.

Sail-fishes.

(*Istiophorus* Lacépède, Hist. Nat. Poiss. iii, 1802, 374: type *Istiophorus gladifer* Lac.= *Scomber gladius* Broussonet.)

Sword-fishes with small teeth on the jaws and palatines, with the ventral fins present, of 2 or 3 rays, and with the dorsal fins extremely high, contiguous, its height much greater than that of the body; anal fin divided. Body slender, much compressed, covered with elongate scales. Intestines short, nearly straight; air-bladder sacculate. The sword is usually shorter than in *Xiphias*, and the lower jaw more developed. The skin is also rougher. Large fishes of the warm seas. (ἱστιον, sail; φορέω, to bear.)

665. H. gladius (Brouss.) Gthr.—*Sail-fish.*

Membrane of dorsal fin with numerous small spots. Dermal productions lanceolate. Upper profile of head descending in a straight line. Snout longer than the rest of the head. Head 4 in total length; depth 7 or 8 in the same. D. 46–7; A. 10–7; V. 2. Vertebræ 14+10. (*Günther.*) Atlantic and Indian oceans; occasional on our coast.

(*Scomber gladius* Brouss. Mèm. Acad. Sci. 1786, 454; Günther, ii, 513: *Histiophorus indicus* Cuv. & Val. viii, 293: *Histiophorus americanus* Cuv. & Val. viii, 303.)

Family LXXIII.—TRICHIURIDÆ.

(*The Hair-tails.*)

Scombroid fishes with the ventral fins imperfect or wanting and the spinous and soft parts of the dorsal not differentiated. Body extremely elongate, compressed, naked. Mouth wide, the jaws armed with strong unequal teeth. Premaxillaries not protractile. Pseudobranchiæ present. Gills 4, a slit behind the fourth; gill-membranes separate, free from the isthmus. Lateral line present. Dorsal fin very long, low, usually continuous, the rays all similar. Caudal fin small or absent; if present, forked. Anal fin very long and low, sometimes scarcely rising above the surface of the skin. Ventrals thoracic, rudimentary or wanting. Vertebræ of abdomen and tail in greatly increased number. Air-bladder present. Pyloric cœca numerous. Genera about 5; species 12,

in the tropical seas. Very close to the *Scombridæ*, from which group, as here understood, the *Trichiuridæ* differ chiefly in the non-differentiation of the dorsal spines. (*Trichiuridæ* part; Günther, 342–349.)

* No caudal fin; tail tapering to a point; dorsal fin single; no ventral fins.
TRICHIURUS, 212.

212.—TRICHIURUS Linnæus.

Hair-tails.

(*Lepturus* Artedi; Gill.)

(Linnæus, Syst. Nat. xii, 1766: type *Trichiurus lepturus* L.)

Body extremely elongate, band-like, the tail very slender, tapering to a fine point, without caudal fin. Head long, with a very wide mouth, the jaws armed with unequal and very strong teeth; upper jaw with about four long, strongly compressed barbed teeth; teeth on the palatines, none on the vomer. Lower jaw longest, preorbital covering cleft of mouth posteriorly. Dorsal fin single, low, occupying the whole of the back, the spines not distinguishable from the soft rays; anal very long, its base more than half the length of the body; composed of detached spines, which are very short, nearly hidden in the skin, the anterior directed backwards, the posterior forwards; ventral fins wanting or reduced to small, scale-like appendages; pectorals small. No scales. Lateral line decurved, concurrent with the belly. Vertebræ 39 + 120. Color silvery. Voracious fishes of the high seas; reaching a considerable size. (*τριχίον*, a little hair; *οὐρά*, tail.)

a. Ventral fins entirely wanting in the adult. (*Trichiurus*.)

666. T. lepturus Linn.—*Hair-tail.*

Uniform brilliant silvery; dorsal dark-edged. Snout long and pointed, about as long as pectoral; maxillary reaching nearly to pupil, concealed by preorbital. Head about 7½ in length; depth about 16. Eye 2 in snout. D. 135; A. about 100. Warm seas, north to Virginia and Lower California.

(Linn. Syst. Nat. xii; Günther, ii, 346.)

FAMILY LXXIV.—SCOMBRIDÆ.

(*The Mackerels.*)

Body elongate, not much compressed, covered with minute cycloid scales, or else wholly naked; the scales anteriorly sometimes forming a corselet. Lateral line present, its course undulate. Head subconic,

pointed anteriorly. Mouth rather large; premaxillary not protractile; maxillary without supplemental bone; jaws with sharp teeth, large or small. Vomer and palatines toothed or not. Preopercle entire; opercle unarmed. Gill-openings very wide, the membranes not united, free from the isthmus. Gill-rakers usually long. Pseudobranchiæ present, large. A slit behind fourth gill. Branchiostegals 7. Dorsal fins 2, the first of rather weak spines, depressible in a groove, the second similar to the anal; anal spines weak; last rays of dorsal and anal usually detached and separate, forming series of finlets; caudal peduncle extremely slender, usually keeled, the caudal lobes abruptly diverging, falcate; ventral fins moderate, thoracic, I, 5. Vertebræ in greater number than in *Carangidæ*, the number more than 25. Pyloric cœca numerous. Air-bladder frequently absent. Coloration metallic, often brilliant. Genera 17; species about 70. Fishes of the high seas, many of them cosmopolitan, and all having a wide range. Most of them are valued as food-fishes.

(*Scombridæ* pt. and *Trichiuridæ* pt. Günther, ii, 349–373.)

a. Finlets present; dorsal spines less than 20. (*Scombrinæ.*)
  b. Spinous dorsal short (of less than 12 spines), remote from the second.
    c. Vomer and palatines with teeth; corselet obsolete.....SCOMBER, 213.
    cc. Vomer and palatines toothless; corselet well developed.....AUXIS, 214.
  bb. Spinous dorsal long (of more than 12 spines), contiguous to the second.
    d. Caudal keel present.
      e. Corselet imperfect or obsolete; teeth of jaws strong; minute teeth on vomer and palatines.....SCOMBEROMORUS, 215.
    ee. Corselet developed.
      f. Palatine teeth strong; vomer toothless; vertebræ normal...SARDA, 216.
      ff. Palatine teeth villiform.
        g. Vomer with teeth; vertebræ normal, the lower foramina small. ORCYNUS, 217.
        gg. Vomer toothless; abdominal vertebræ with the lower foramina enlarged and a portion between the vertebræ proper and the hæmapophyses developed in the form of a net-work or trellis....EUTHYNNUS, 218.

213.—SCOMBER Linnæus.

Mackerels.

(Linnæus, Syst. Nat. 1758: type *Scomber scombrus* L.)

Body fusiform, rather elongate, somewhat compressed; caudal peduncle slender, with two small keels on each side. Mouth wide, with a single row of rather small, slender teeth in each jaw and on the vomer and palatines; maxillary slipping under the broad preorbital. Scales very small, not forming a corselet. First dorsal of 7–12 feeble spines, separated from the second by an interspace greater than the base of the fin; second dorsal small, followed by 5–9 detached finlets; anal similar to second dorsal, with similar finlets; pectorals and ventrals small, the

former on a level with the eyes; caudal fin small, widely forked. Pyloric appendages exceedingly numerous. Air-bladder usually wanting. Species few, widely distributed, everywhere highly valued for food. (*σκόμβρος*, Latin *Scomber*, the ancient name of the common mackerel.)

a. Air-bladder present, small.

667. S. pneumatophorus De la Roche.—*Chub Mackerel; Tinker Mackerel; Easter Mackerel.*

Blue, with about 20 wavy, blackish streaks, which extend to just below the lateral line; some of these form reticulations, and inclose pale spots of the color of the back; belly and sides silvery; a black axillary spot. Head rather pointed. Maxillary reaching front of pupil. Eye 4 in head, nearly equal to snout; pectoral $\frac{2}{5}$ length of head. Head $3\frac{3}{4}$; depth 5. D. IX—I, 12—V; A. I—I, 11—V. Lat. l. 200. L. 1 foot. Atlantic and Pacific, north to Maine and San Francisco; common in the Mediterranean and in Southern California; irregular in its appearance on our Atlantic coast.

(De la Roche, Ann. Mus. Nat. Hist. xiii, 315; Günther, ii, 359: *Scomber grex* Mitch. Trans. Lit. & Phil. Soc. N. Y. 1815, 422: *Scomber dekayi* Storer, Fish. Mass. 1867, 52: *Scomber diego* Ayres, Proc. Cal. Acad. Nat. Sci. i, 92, 1855: *Scomber colias* pt. Steindachner, nec *Scomber colias* of Günther and C. & V., which has but 7 dorsal spines.)

aa. Air-bladder wanting.

668. S. scombrus L.—*Common Mackerel.*

Lustrous dark blue above, with about 35 wavy, blackish, transverse streaks; below silvery; base of pectorals dark. Snout rather long and pointed, compressed. Mouth large, maxillary extending to anterior margin of orbit. Ventrals and pectorals short, the former nearly half length of head. Eye less than snout, 5 in head. Head 4 in length; depth $5\frac{1}{2}$. D. XII—I, 10—V; A. I, 11—V. L. 18 inches. North Atlantic; abundant on both coasts, and occasionally straying to the Pacific. A well-known food-fish.

(Linn. Syst. Nat.: *Scomber scomber* Günther, ii, 357: *Scomber vernalis* Storer, Hist. Fish. Mass. 54.)

214.—AUXIS Cuvier.

Frigate Mackerels.

(Cuvier, Règne Anim. 1829, ii: type *Scomber rochei* Risso.)

Body oblong, plump, mostly naked posteriorly, anteriorly covered with small scales, those of the pectoral region enlarged, forming a corselet. Snout very short, conical, scarcely compressed. Mouth rather small,

the jaws equal. Teeth very small, mostly in a single series, on the jaws only. Tail very slender, depressed, with a rather large keel on each side. First dorsal short, separated from the second by a considerable interspace. Second dorsal and anal small, each with 7 or 8 finlets. Pectorals and ventrals small. No air-bladder. Branchiostegals 7. Pyloric cœca dendritical. Gill-rakers very long and slender, numerous. Vertebræ peculiarly modified, essentially as in *Euthynnus*. (αὐξις, an ancient name of a young tunny, from αὔξω, to grow.)

669. A. rochei (Risso) Günther.—*Frigate Mackerel.*

Blue, variegated with darker above, becoming plain with age; belly silvery. Body robust, scarcely compressed, abruptly contracted at caudal peduncle. Eye as long as snout, 5 in head. Opercle very broad. Scales of corselet and along anterior dorsal region comparatively large. Maxillary almost entirely concealed by preorbital. Dorsal spines rather stiff; space between dorsals four-fifths length of head. About 33 gill-rakers below angle. Pectoral reaching past middle of first dorsal. Head 4; depth 4¼. D. X–12–VIII; A. 13–VII. Vert. 39. Mediterranean to the East Indies; lately appearing in great numbers on our Atlantic coast. A food-fish of little value.

(*Scomber rochei* Risso, Ichth. Nice, 1810, 165; Günther, ii, 369: *Scomber bisus* Rafinesque, Caratteri, etc. 1810, 45: *Auxis vulgaris* Cuv. & Val. viii, 139.)

215.—SCOMBEROMORUS Lacépède.

(*Cybium* Cuvier.)

(Lacépède, Hist. Nat. Poiss. iii, 292, 1802: type *Scomberomorus plumierii* Lac. = *Scomber regalis* Bloch.)

Body elongate, naked or with rudimentary scales, which do not form a distinct corselet. Head pointed, comparatively short and small. Mouth wide, the strong teeth in the jaws often compressed or knife-shaped; villiform or sand-like teeth on the vomer and palatines; maxillary not concealed by preorbital. Spinous dorsal low, of 14–18 feeble spines. Soft dorsal and anal short, similar, somewhat elevated and falcate, each followed by 7 to 10 finlets; ventrals small; pectorals moderate, near the level of the eye. Air-bladder present. Vertebræ normal. Fishes of the high seas; graceful in form and beautiful in color; among the best of food-fishes. (σκομβρος, Scomber; δμορος, near.)

670. S. concolor (Lockington) J. & G.

Male dark steel-blue, the sides silvery, without streaks or spots; female with two alternate series of brown spots, the silvery on sides

clouded with dusky; fins nearly plain, dark. Mouth slightly oblique, the maxillary reaching to posterior margin of pupil. Teeth of jaws comparatively small, subconical, little compressed; those of vomer and palatines minute and granular. Eye $5\frac{1}{2}$ in head. Pectoral fins 8 in length, inserted rather above axis of body; ventral fins small; spines of dorsal slender and fragile, the longest one-fourth as long as the head; dorsal fins separated by an interspace equal to one-third the length of base of spinous dorsal; caudal shorter than head, its lower lobe longest. Gill-rakers long, 18 below angle. Head about 5; depth rather less. D. XVII–16–VIII; A. I, 16–VIII. Monterey Bay, California; rare. A food-fish of high quality.

(*Chriomitra concolor* Lockington, Proc. Acad. Nat. Sci. Phila. 1879.)

671. S. maculatus (Mitch.) J. & G.—*Spanish Mackerel.*

Bluish and silvery above with bright reflections; sides with numerous bronze spots which are nearly round and about as large as the pupil. Spinous dorsal white at base, dark above and on the anterior half of the fin. Caudal keel well developed, with a smaller keel above and below it. Head small and pointed. Mouth rather large, oblique; maxillary reaching posterior margin of orbit. Teeth large, compressed, about 32 in each jaw. Gill-rakers few, slender, about 12 below angle. Interspaces between dorsals shorter than eye; caudal as long as head. Head $4\frac{3}{4}$ in length; depth $5\frac{1}{4}$. D. XVIII–18–IX; A. II, 17–VIII. Coasts of North America, north to Cape Cod and Lower California; one of our most valued food-fishes.

(*Scomber maculatus* Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 426, 1815: *Cybium maculatum* Günther, ii, 372: *Cybium maculatum* Holbrook, Ichth. S. Car. 66.)

672. S. regalis (Bloch) J. & G.—*Cero.*

Silvery; sides with a brownish, broken, longitudinal band, above and below which are numerous brownish spots, persistent in the adult; anterior portion of spinous dorsal black. Body rather elongate, its dorsal and ventral curves about equal. Lateral line descending obliquely, slightly undulate along the tail. Mouth large; maxillary reaching to below eye. Teeth triangular, strongly compressed, about 20–16. Pectoral scaly. Head 4 in length; depth $4\frac{1}{2}$. D. XVII–I, 15–VIII; A. II, 15–VIII. Cape Cod to Brazil; not common on our Atlantic coast; reaches a weight of 20 pounds.

(*Scomber regalis* Bloch, Ausl. Fische, taf. 333: *Cybium regale* Günther, ii, 372: *Scomberomorus plumierii* Lac. iii, 292: *Cybium acervum* C. & V. viii, 1831, 186: *Cybium regale* Poey, Proc. U. S. Nat. Mus. 1878, 4.)

673. S. caballa (Cuv. & Val.) J. & G.—*Sierra.*

Sides of body with indistinct darker yellowish spots; adult immaculate; spinous dorsal without black blotch anteriorly. Eye large. Mouth large, maxillary reaching to below eye. Lateral line descending abruptly below the second dorsal. Teeth triangular, strongly compressed, about 30–25. Pectoral scaly at base only. D. XIV–I, 15–VIII; A. II, 15–VIII. (*Poey.*) Warm parts of the Atlantic; occasional on our coast; reaches a weight of 100 pounds.

(*Cybium caballa* Cuv. & Val. viii, 1831, 187: *Cybium caballa* Günther, ii, 373: *Cybium immaculatum* C. & V. viii, 191: *Cybium caballa* Poey, Proc. U. S. Nat. Mus. 1878, 4.)

216.—SARDA Cuvier.

Bonitos.

(*Pelamys* Cuv. & Val. 1831, preoccupied in Herpetology.)

(Cuvier, Règne Anim. ed. 2d, ii, 1829: type *Scomber pelamys* Brünnich=*Scomber sarda* Bloch.)

Body rather elongate, covered with small scales, those of the pectoral region forming a corselet. Caudal peduncle slender, strongly keeled. Head large, pointed, compressed. Mouth large. Teeth in the jaws rather strong, conical, slightly compressed; similar teeth on the palatines, but none on the vomer; maxillary not concealed by preorbital. Gill-rakers long and strong. First dorsal long and rather low, of 18–22 rather stout spines, which are gradually shortened behind; interval between the last spine and the second dorsal short; second dorsal small, followed by 8–9 finlets; anal fin similar, usually with one less finlet; paired fins small; pectorals placed below the level of the pupil. No air-bladder. Pyloric cœca very numerous, dendritical. Vertebræ normal. Fishes of rather large size, with metallic coloration. (Latin, *sarda;* Greek, *σάρδα*, the ancient name of the typical species, also known as *Amia*, *Pelamys*, etc.; so called from its being taken in the neighborhood of the island of Sardinia; hence also the diminutive *σαρδίνη*, the Sardine.)

674. S. mediterranea (Bloch & Schneider) J. & G.—*Bonito; Skip-jack.*

Dark steel-blue above, with numerous narrow, dark stripes from the back obliquely downwards and forwards; silvery below. Body elongate, scarcely compressed, robust; corselet distinct, small, not extending beyond pectoral. Teeth moderate, slightly compressed. Gill-rakers rather small, 13 below angle. Maxillary reaching beyond orbit. Head $3\frac{3}{4}$ in length; depth 4. D. XXI–I, 13–VIII; A. I, 13–VII; P. 10. L. $2\frac{1}{2}$ feet.

Atlantic Ocean, on both coasts; abundant; a food-fish of rather low grade.

(*Scomber pelamys* Brünnich, Ichth. Massil. 1768, 69, not of L. Syst. Nat.: *Scomber mediterraneus* Bloch & Schn. 1801, 23: *Pelamys sarda* Storer, Fish. Mass. 63: *Pelamys sarda* Günther, ii, 367: *Sarda pelamys* Gill.)

675. S. chilensis (Cuv. & Val.) J. & G.—*Bonito; Skip-jack; Tuna.*

Dark metallic blue; sides dusky; about 5 blackish stripes running obliquely upward and backward from the pectoral region to the upper edge of the tail, these variable in number and direction. Head pointed, conical, naked. Maxillary reaching posterior border of eye. Pectorals placed just below the level of the pupil, scarcely half as long as head. Gill-rakers long, strong, about 18 below angle. Corselet moderately developed. Head $3\frac{3}{4}$; depth about 4. D. XVIII–I, 12–VIII; A. II, 11–VI. L. 2–3 feet; weight 16 pounds. San Francisco to Patagonia and Japan; abundant northward in summer; very similar to the preceding but with the spinous dorsal always shorter.

(*Pelamys chilensis* Cuv. & Val. viii, 163: *Pelamys lineolata* Girard, U. S. Pac. R. R. Surv. Fish. 106: *Pelamys chilensis* Günther, ii, 106: *Pelamys orientalis* Günther, ii, 106.)

217.—ORCYNUS Cuvier.

Tunnies.

(*Thynnus* Cuvier, 1817, preoccupied in entomology.)

(Cuvier, Règne Anim. 2d ed. 1829: type *Scomber thynnus* L.)

Body oblong, robust, with very slender caudal peduncle. Head conical. Mouth wide, with one series of small, conical teeth in the jaws and bands of minute villiform or sand-like teeth on the vomer and palatines. Scales present, those of the pectoral region forming an obscure corselet. First dorsal of 12–15 spines which grow gradually shorter backward, the interval between last spine and second dorsal slight; second dorsal and anal short and rather high, each with 8–10 finlets; ventrals moderate; pectorals moderate or very long, rather below the level of the eye. Vertebræ normal, the lower foramina very small. Fishes of the open seas; often attaining a very great size. (ὀρκύνος, an ancient name of *O. thynnus*.)

a. Pectoral fins sabre-shaped, reaching beyond end of second dorsal. (*Albicores.*)

676. O. alalonga (Gmel.) Risso.—*Albicore; Alilonghi; Germon.*

Bright metallic steel-blue; belly bluish silvery; fins colored like the body; pectorals blackish, with silvery lustre. Body little compressed, regularly elliptical, its weight great in proportion to the length. Tail

strongly keeled, broader than deep. Corselet indistinct. Scales rather large. Pectoral reaching beyond second dorsal and anal, inserted a little below level of pupil, its base a little wider than the large eye; ventrals short. Head $3\frac{1}{4}$; depth $3\frac{1}{2}$. D. XIV–II, 12–VIII; A. II, 12–VII. L. 3 feet; weight 15–20 pounds. In all warm seas, in the open ocean; abundant in summer in the Mediterranean and about the Santa Barbara Islands; occasional on our Atlantic coast.

(*Scomber alatunga* Gmel. Syst. Nat. 1788, 1330, misprint for *alalonga*, *fide* Cuv. & Val.: *Thynnus alalonga* Cuv. & Val. viii, 120: *Thynnus pacificus* Cuv. & Val. viii, 133: *Thynnus albacora*, *alalonga*, and *pacificus* Günther, ii, 365, 366: *Orcynus pacificus* Cooper, Proc. Cal. Acad. Nat. Sci. 1863, 75: *Orcynus germo* Lütken, Spolia Atlantica, 1880, 473.)

a. Pectoral fins comparatively short, not reaching beyond the end of the spinous dorsal. (*Tunnies.*)

677. O. thynnus (Linn.) Poey.—*Tunny; Horse Mackerel; Albicore.*

Dark blue above; below greyish with silvery spots. Mouth rather large; posterior margin of preopercle somewhat shorter than inferior. Eye small. Dorsal and anal falcate; caudal very widely forked; pectorals reaching nearly to end of spinous dorsal. Head $3\frac{3}{4}$ in length; depth 4. D. XIV–I, 13–IX; A. I, 12–VIII. North Atlantic, on both coasts; the largest of the *Scombridæ*, reaching a length of 10 feet or more and a weight of half a ton.

(*Scomber thynnus* Linn. Syst. Nat.: *Thynnus secundo-dorsalis* Storer, Fish. Mass. 65: *Thynnus thynnus* Günther, ii, 362: *Tnynnus vulgaris* C. & V. viii, 58: *Thynnus brachypterus* and *coretta* Günther, ii, 363.)

218.—EUTHYNNUS Lütken.

Little Tunnies.

(*Thynnus* Lütken: *Thynnichthys* Giglioli; both names preoccupied.)

(Lütken MSS. in Epist. Feb. 1881: type *Thynnus thunnina* C. &. V.)

This genus differs from *Orcynus*, according to Lütken*, "(1) in the absence of teeth on the vomer; (2) by the complete absence of scales outside of the corselet, while in the *Orcyni* of the same size the skin is covered with smali scales; the limits of the corselet in the Tunny and Albicore are obscure, so that it cannot properly be said that they have distinct corselets; and (3) by an important osteological character, namely the peculiar development, in the form of a net-work or trellis, of a portion of the abdominal part of the backbone, between the vertebræ proper and the hæmapophyses. This organization is common to *Th. thunnina* (*alliteratus*) and *Th. pelamys*, and is found modified in

* *Spolia Atlantica*, 1880, 596.

the genus *Auxis*." Species of smaller size than the Tunnies, mostly pelagic. (*Baird.*) (ευ, true; θυννος, tunny.)

678. E. alliteratus (Raf.) J. & G.—*Little Tunny; Albicore.*

Bluish above with wavy, blackish, longitudinal streaks; silvery below. Inferior margin of preoperculum half longer than posterior. Dorsal spines moderate; pectorals reaching the vertical from the ninth dorsal spine. Head $3\frac{3}{4}$ in length; depth $4\frac{1}{4}$. D. XV–I, 12–VIII; A. I, 12–VII. Atlantic Ocean; occasional on our coast.

(*Scomber alliteratus* Raf. Caratteri di Alcuni Nuovi Generi, 1810, 46: *Thynnus affinis, thunnina,* and *brevirostris* Günther, ii, 363–365.)

679. E. pelamys (L.) Lütken.—*Oceanic Bonito.*

Back bluish; on each side of the belly 4 brownish longitudinal bands. Length of posterior margin of the preoperculum $1\frac{2}{3}$ in that of the inferior. Pectoral reaching the vertical from the tenth dorsal spine; dorsal spines rather feeble. Head $3\frac{1}{2}$; depth 4 (to fork of caudal). D. XV–I, 12 + VIII; A. II, 12 + VII. (*Günther.*) Tropical seas; occasional on our Atlantic coast.

(*Scomber pelamys* L. Syst. Nat.: *Thynnus pelamys* Günther, ii, 365: *Thynnus pelamys* Cuv. et Val. viii, 113.)

Family LXXV.—CARANGIDÆ.

The Pilot-fishes.

Scombroid fishes, with the body more or less compressed and often elevated, sometimes naked, or more usually covered with small, thin, cycloid scales. Head compressed, the occipital keel prominent, usually trenchant. Mouth of varying size, the dentition various, the teeth generally small; premaxillaries usually protractile; maxillary with or without a supplemental bone; preopercle usually entire in the adult, in the very young armed with three or more spines.* Lateral line complete, anteriorly arched, the posterior part straight, sometimes armed with bony plates. Dorsal fins more or less separated, the spinous part rather weak, the spines usually depressible in a groove; anal fin long, similar to the soft dorsal, always preceded by two stiff spines, usually separate, but in the young often more or less connected with the fin or with each other; these sometimes disappear with old age, and sometimes the spinous dorsal also vanishes; often a procumbent spine before the dorsal fin; ventral fins thoracic, well developed, I, 5; caudal peduncle very slender, the fin widely forked; pectoral fins narrow. Gill-openings very wide, the membranes usually not united, free from the isthmus. Gills 4, a slit

* For an account of the transformations of various members of this family, see Lütken, *Spolia Atlantica,* 1880.

behind the last. Gill-rakers usually long. Branchiostegals commonly 7. Air-bladder present, often bifurcate behind. Pseudobranchiæ large, present in all our genera, sometimes disappearing with age. Œsophagus unarmed. Pyloric cœca generally numerous. Vertebræ fewer than in the *Scombridæ*, about 25 in number. Coloration generally metallic and silvery. Genera 25; species about 180, abounding in warm seas, often moving northward in summer, like the *Scombridæ*. Most of the species are widely distributed, and nearly all are valued as food.

(*Carangidæ* pt. Günther ii, 417–485, exclusive of certain genera.)

* Lateral line armed with bony keeled plates, at least posteriorly. (*Caranginæ.*)
a. Armature of lateral line extending its whole length.....TRACHURUS, 219.
aa. Armature of lateral line on its straight posterior portion only.
b. Dorsals and anal each with a detached finlet.....DECAPTERUS, 220.
bb. Dorsal and anal without finlets.
c. Spinous dorsal developed.....CARANX, 221.
cc. Spinous dorsal rudimentary or disappearing with age; scales rudimentary. BLEPHARIS, 222.

** Lateral line unarmed.
d. Premaxillaries protractile.
e. Anal fin about equal to the soft dorsal, its base longer than the abdomen; tail not keeled.
f. Thoracic region trenchant; body excessively compressed.
g. Dorsal outline more convex than the ventral outline; profile very steep; head very short and high; preorbital very deep. (*Seleninæ.*) SELENE, 223.
gg. Dorsal outline less convex than ventral; profile not steep; preorbital moderate. (*Chloroscombrinæ.*).....CHLOROSCOMBRUS, 224.
ff. Thoracic region not trenchant; body moderately compressed. (*Trachynotinæ.*)
h. Forehead convex.....TRACHYNOTUS, 225.
ee. Anal fin much shorter than the soft dorsal, its base not longer than the abdomen; tail keeled. (*Seriolinæ.*)
i. Finlets none.
j. Dorsal spines free, in adult.....NAUCRATES, 226.
jj. Dorsal spines connected by membrane.....SERIOLA, 227.
ii. A two-rayed finlet behind dorsal and anal.....ELAGATIS, 228.
dd. Premaxillaries not protractile; dorsal and anal with finlets; maxillary very narrow, without distinct supplemental bone. (*Scombroidinæ.*).....SCOMBROIDES, 229.

219.—TRACHURUS Rafinesque.

Saurels.

(Rafinesque, Indice d'Ittiologia Siciliana 1810, 20: type *Scomber trachurus* L. = *Trachurus saurus* Raf.)

Body rather elongate, somewhat compressed, not elevated, tapering to a slender caudal peduncle, which is as broad as deep. Scales present, not very small. Lateral line armed throughout with plates, those on the caudal peduncle larger and spinous; an accessory dorsal branch to the lateral line. Snout rather long. Mouth moderate. Minute teeth mostly

in single series on jaws, vomer, and palatines. Dorsals two, the first preceded by a procumbent spine. No finlets. Two strong spines before the anal, connected by membrane. Pyloric cœca numerous. In all warm seas. (*τραχούρος*, the ancient name of *T. saurus;* from *τραχυς*, rough; *ουρα*, tail.)

680. T. symmetricus (Ayres) Girard.—*Horse Mackerl.*

Similar to *T. saurus*, but slenderer and less compressed. Arch of lateral line longer, as long as straight part, the junction of the two much beyond tip of pectoral; plates on the anterior part small, crowded, their height less than half eye. Head $3\frac{3}{4}$; depth $4\frac{2}{3}$. D. VIII–I, 31; A. II–I, 27; Lat. l. 48 + 47. Coast of California, from San Francisco southward; very abundant in summer.

(*Caranx symmetricus* Ayres, Proc. Cal. Acad. Nat. Sci. i, 1855, 62; Girard, Pac. R. R. Surv. Fish. 107.)

981. T. saurus Raf.—*Horse Mackerel; Skip Jack; Saurel.*

Greenish, sides silvery; a dusky opercular spot. Body more compressed and deeper than in the preceding. Head rather long. Mouth moderate, the maxillary reaching the front of eye. Eye large, equal to snout, $\frac{1}{4}$ in head; arch of lateral line short, reaching scarcely beyond pectoral, $1\frac{1}{3}$ in straight part, the plates high, nearly as high anteriorly as posteriorly, their height more than half eye. Head $3\frac{1}{2}$; depth 4. D. VIII–I, 29; A. II–I, 28; Lat. l. 40 + 37. L. 1 foot. Southern Europe; occasional on our South Atlantic coast.

(*Scomber trachurus* Linn. Syst. Nat. i, 1758: *Caranx trachurus* Lacépède, iii, 63: ? *Caranxomorus plumierianus* Lacép. Hist. Nat. Poiss. iii, 84: ? *Selar japonicus* Bleeker, Verh. Bat. Gen. xx, vi, Japan, pl. 8: *Trachurus saurus* Rafinesque, l. c. 20: *Trachurus trachurus* Günther, ii, 419.

220. DECAPTERUS Bleeker.

Mackerel Scads.

(Bleeker, Natuurk. Tydschr. 1855, v, 417: type *Caranx kurra* Cuv. & Val.)

Body elongate, little compressed, almost perfectly fusiform. Head short, pointed. Mouth rather small; jaws about equal, the dentition feeble. A supplementary maxillary bone. Premaxillaries protractile. Scales moderate, enlarged and spinous along lateral line posteriorly; second dorsal and anal each with a single detached finlet; free anal spines very strong. Abdomen rather shorter than anal fin. Gill-rakers long and slender. Species numerous. (*δεκάς*, ten; *πτερόν*, fin; there being ten fins, counting the spurious finlets and excluding the free spines.)

682. D. punctatus (Agassiz) Gill.—*Scad; Round Robin.*

Bluish above, silvery below; a dark opercular spot. Eye rather small, shorter than snout, about equal to the width of cheeks or the in-

terorbital space. Maxillary reaching front of eye. Teeth on vomer and palatines, none on tongue; teeth in jaws in single series. Lateral line little arched; arch of lateral line nearly as long as straight part. Scutes numerous, deep, crowded, about 40. Pectorals short, shorter than head. Breast, cheeks, and top of head scaly. Depth 5 in length; head $4\frac{1}{3}$. D. VIII–I, 30–I; A. II–I, 24–I. L. 12 inches. New York to the West Indies; not common on our coast.

(*Caranx punctatus* Agassiz, Spix. Pisc. Bras. 1829, 108: *Caranx punctatus* Günther, II, 426.)

683. D. macarellus (Cuv. & Val.) Gill.—*Mackerel Scad.*

Silvery, plumbeous below; a small black spot on the opercle. Lateral line nearly straight. Head 5; depth 6. D. VIII–I, 33–I; A. II—I, 27–I; scutes 25. (*Günther.*) Warm parts of the Atlantic, northward to Cape Cod; scarce on our coast.

(*Caranx macarellus* Cuv. & Val. ix, 40: *Caranx macarellus* Günther, ii, 426.)

221.—CARANX Lacépède.

Crevallés.

(*Caranx, Carangops, Carangus, Paratractus*, and *Trachurops* Gill; *Caranx, Gnathanodon, Selar, Carangoides, Carangichthys*, etc. Bleeker.)

(Commerson; Lacépède Hist. Nat. des Poiss. 1802, iii, 72: type *Scomber speciosus* Forskål.)

Body ovate or oblong, compressed, the back sometimes considerably elevated, sometimes little arched. Head moderate or rather large, more or less compressed. Mouth moderate or large, oblique; maxillary with a well-developed supplemental bone, extending to below the eye. Premaxillaries protractile. Teeth variously developed; sometimes minute, granular, and deciduous (*Caranx*), sometimes with an outer row of stronger teeth (*Selar*, etc.) or with small canines (*Carangus*); villiform teeth often present on vomer, palatines, and tongue. Gill-rakers long. Eye large, with an adipose eyelid. Dorsal spines rather low, connected; second dorsal long, elevated in front; both fins depressible in a groove. Anal fin similar to second dorsal and nearly as long, preceded by two rather strong spines, its base longer than the abdomen. Caudal fin strongly forked, the peduncle very slender. Ventral fins moderate; pectorals falcate; no finlets. Scales present, usually very small. Lateral line with its posterior portion armed with strong bony plates, which grow larger on the tail, each plate armed with a spine; a short dorsal branch of lateral line, usually present. Preopercle entire in the adult, serrate in the young, usually with a membranaceous border. Species

very numerous in all warm seas, most of them valued for food. As here understood, this genus includes a considerable variety of forms, differing in the dentition and in the shape of the body. Its members seem, however, to form an almost unbroken series from one extreme to another. (*κάρα*, head. "À cause de l'espèce de prominence que presente leur tête, de la force de cette partie, de l'éclat dont elle brille, et d'ailleurs pour annoncer la sorte de puissance et de domination que plusieurs osseux de ce genre exercent sur un grand nombre des poissons que frequentent les rivages" *Lacépède*).

Our species may be divided as follows:

a. Teeth present, small, nearly uniform, or the outer somewhat enlarged; no canines. (*Selar* Bleeker.)
b. Body fusiform, elongate ..... *crumenophthalmus.*
bb. Body ovate or subfusiform.
c. Depth one-third or less than one-third the length to base caudal. *pisquetus; caballus; cibi.*
cc. Depth more than one-third the length ..... *beani; falcatus.*
aa. Teeth unequal; lower jaw with small canines. (*Carangus*) ..... *fallax; hippus.*

a. Teeth present, small, nearly uniform; the outer row sometimes enlarged; no canines. (*Selar** Bleeker.)
b. Body fusiform, elongate. (*Trachurops* Gill.)

684. C. crumenophthalmus (Bloch) Lac.—*Goggler; Big-eyed Scad.*

Bluish olive above, silvery below, a faint opercular spot. Body oblong-elongate, little compressed, the back not elevated. Head elongate, rather pointed, the lower jaw projecting; maxillary reaching past the front of the eye, which is very large, longer than snout, about 3 in head. Eye much deeper than the cheeks and greater than the interorbital width. A single series of small teeth in each jaw; very weak teeth on vomer and palatines; a patch of teeth on tongue. Shoulder-girdle near isthmus with a fleshy projection, in front of which is a deep cross-furrow; adipose eyelid largely developed. Scales comparatively large. Cheeks and breast scaly. Gill-rakers long, numerous. Lateral line scarcely arched, its scutes weak, but little carinated. Dorsal spines slender; free anal spines strong; pectorals falcate, nearly as long as head. An angle at lower posterior part of opercular region as in *Clupea*. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. VIII–I, 26; A. II–I, 22; scutes 35. Cape Cod to Madagascar; abundant in tropical seas.

(*Scomber crumenophthalmus* Bloch, taf. 343; Günther, ii, 429: *Trachurops crumenophthalmus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 431.)

bb. Body ovate or subfusiform.
c. Depth one-third or less the length to base of caudal.

* Bleeker, Natuurk. Tydschr. 1855, v, 417.

685. C. pisquetus Cuv. & Val.—*Crevallé.*

Greenish olive, golden yellow below; a black blotch on opercle. Body oblong, moderately elevated, the dorsal and ventral outlines about equally arched. Profile forming a uniform curve. Snout rather sharp. Mouth slightly oblique, a little below axis of body. Maxillary reaching about to middle of orbit. Teeth comparatively large; a single series in lower jaw; upper jaw with an inner series of smaller teeth; no canines; teeth on vomer, palatines, and tongue. Eye rather small, shorter than snout, $3\frac{1}{2}$ in head. Gill-rakers long, numerous. Pectoral as long as head, barely reaching anal, its broad basal part half its length. Scales moderate; cheeks and breast scaly. Top of head naked, with series of mucous pores. Lateral line with a weak arch anteriorly, which is about half length of straight portion. Lateral scutes numerous, developed on whole straight part of lateral line. Head $3\frac{3}{4}$; depth 3. D. VIII–I, 24; A. II–I, 19; Lat. l. 50 (scutes). L. 1 foot. Cape Cod to West Indies; the most abundant of the *Carangidæ* on our Atlantic coast northward.

(Cuv. & Val. ix, 97: *Caranx hippos* Holbr. Ichth. S. C. 1860, 90: *Paratractus pisquetus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 432: *Caranx chrysos* Günther, ii, 445.)

686. C. caballus Günther.

Greenish above, silvery below; a black blotch on the opercle, none elsewhere. Form of *C. pisquetus;* rather elongate, not greatly compressed; the dorsal and ventral outlines regularly and nearly equally arched; a low occipital carina; a prominent supraocular ridge. Scales comparatively large, the scaly sheaths of the vertical fins well developed. Cheeks and upper part of opercles scaled; breast scaled, jaws naked. Teeth in a narrow band above, those in front somewhat enlarged, those of lower jaw mostly in one series; feeble teeth on tongue, vomer, and palatines. Mouth rather small, the jaws nearly equal; maxillary reaching front of pupil. Eye large, $3\frac{1}{2}$ in head, the adipose eyelid unusually developed. Gill-rakers numerous, very long and slender, 28 below angle. Curve of lateral line low, the straight part beginning under first ray of second dorsal, at a distance rather more than length of head; length of arch $1\frac{2}{3}$ in straight part. Scutes of lateral line strong. Pectoral fins very long, slender, and falcate, their length considerably more than that of the head; a little less than 3 times in length of body, their tips reaching fourth anal ray; the broad basal part forming little more than one-third the total length of the fin; ventrals short; a concealed spine before dorsal; second dorsal and anal a little elevated in front, the long-

est ray nearly half length of head, the last rays of the fin scarcely rising above the scaly sheath. Head 4; depth $3\frac{1}{2}$. D. VIII–I, 24; A. II–I, 21; Lat. l. 41 (developed scutes). San Diego, Cal., to South America. (Description from original types of *T. boops*.)

(*Trachurus boops* Girard, U. S. Pac. R. R. Surv. Fish. 1859, 108, not *Caranx boops* of C. & V.: *Caranx caballus* Günther, Trans. Zoöl. Soc. Lond. 1869, 431: *Caranx girardi* Steindachner.)

687. C. cibi Poey.

Dusky bluish, golden below, without spots. Body rather elongate, not elevated, muzzle pointed. Profile regularly curved. Maxillary reaching front of eye. Teeth villiform on jaws, vomer, and palatines. Breast and vertical fins scaly. Last spine of dorsal short, strong, free. Pectorals as long as depth of body, falcate; ventrals short. Eye $4\frac{1}{2}$ in head. Head $3\frac{1}{3}$; depth 3. D. VIII–I, 25; A. II–I, 22. West Indies, north to Florida.

(Poey, Memorias, ii, 224, 1858.)

cc. Depth more than one-third the length.

688. C. beani Jordan.

Silvery, bluish above; no black spot on opercles or fins; spinous dorsal and axil dusky. Body ovate, deep and compressed, somewhat elliptical; the profile anteriorly not elevated, forming an even curve continuous from the snout to the base of the dorsal, the snout therefore not blunt. Top of head not much compressed. Premaxillaries on the level of the lower edge of the pupil; maxillary not reaching to opposite the front of the pupil. Teeth rather small, in a narrow band on each jaw, without distinct canines; villiform teeth on tongue, vomer, and palatines. Cheek about as deep as the eye, which is rather small, considerably shorter than snout; adipose eyelid little developed. Gill-rakers long. Breast entirely scaly; soft parts of the vertical fins densely covered with small scales. Pectoral fin falcate, a little shorter than the head, reaching past the front of the anal; caudal equally forked. Plates of lateral line small. Head $3\frac{1}{3}$; depth $2\frac{1}{3}$. D, VIII–I, 27; A. II–I, 23; Lat. l. 28. Beaufort, North Carolina.

(Jordan, Proc. U. S. Nat. Mus. 1880, 486.)

689. C. falcatus Holbr.

Greenish above with blue reflections, sides and below golden or silvery; caudal fin yellow, inner edge of upper lobe black; a black axillary spot, opercle faintly blotched. Body oval, much compressed, with the axis nearly midway between the back and belly; profile very con-

vex. Mouth very small, oblique, the maxillary scarcely reaching the middle of the orbit. Head small, short, about as deep as long. Eye large, as long as snout, $3\frac{1}{2}$ in head. Gill-rakers shortish, rather strong, 20 below arch; anal spines small, the second longest; upper lobe of the caudal falcate, more than a third longer than the lower. Lateral scutes numerous, very strong. Teeth rather strong, in one series in each jaw; teeth on tongue few or none; those on vomer and palatines minute, deciduous; scales small; cheeks naked, breast scaly; lateral line strongly arched, the arch about one-third the straight portion; scaly sheaths of dorsal and anal very high, extending the whole length of fin. Pectoral falcate longer than head, reaching anal. Head $4\frac{1}{3}$; depth $2\frac{1}{2}$. D. VII–I, 28; A. II–I, 25; Lat. l. (scutes) about 50. West Indies northward; not common.

(Holbrook, Ichth. S. C. 1860, 94: *Caranx amblyrhynchus* Gunther, ii, 441, pt. not of C. & V.: *Carangops falcatus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 431.)

aa. Teeth unequal; lower jaw with small canines. (*Carangus* * Grd.)

690. C. fallax C. & V.

Bluish, sides golden or silvery, a very small, black opercular spot. Form of *C. hippus*, but the profile not so strongly arched. Teeth as in *C. hippus*. Breast entirely scaly; anterior part of soft dorsal fin black; no spot on the pectorals. Scutes present on whole of straight part of lateral line; arched part of lateral line $1\frac{2}{3}$ in straight part; an abrupt angle at junction of the two parts. Pectoral shorter than head, maxillary reaching posterior edge of pupil; cheek and upper parts of opercles scaly; scaly sheaths of fins little developed. Head $3\frac{2}{5}$; depth $2\frac{1}{2}$. D. VIII–I, 22; A. II–I, 16; Lat. l. 35 (scutes). Warm seas, north to South Carolina; not common.

(Cuv. & Val. ix, 95: *Caranx hippos* Günther, ii, 449: *Caranx richardi* Holbr. Ichth. S. C. 1860, 96.)

691. C. hippus (L.) Günther.—*Crevallé; Horse Crevallé.*

Olivaceous above; sides and below silvery or golden; a distinct black blotch on opercle and one on lower rays of pectorals, the latter sometimes wanting; axil of pectoral dusky; anterior edge of dorsals black; upper edge of caudal peduncle dusky. Body oblong, the anterior profile very strongly arched. Head large and deep. Mouth large, low, and nearly horizontal below axis of body; lower jaw included; maxillary extending to nearly opposite posterior border of eye. Teeth in upper

* Girard, U. S. Mex. Bound. Surv. Ichth. 1829, 23; type *Scomber carangus* Bloch; name a modification of *Caranx*.

jaw in a broad villiform band; an outer series of large, wide-set, conical teeth; teeth of lower jaw in one row, a distinct canine on each side of symphysis; villiform teeth on vomer, palatines, pterygoids, and tongue. Lateral line with a wide arch, its length ¾ that of straight part; plates not covering all of straight part. Dorsal spines short, rather stout; procumbent spine obsolete. Gill-rakers stout, not very long, 15 below angle. Occipital keel sharp. Eye not very large, longer than snout, 4 in head. Pectoral falcate, longer than head. Breast naked, with a small patch of scales in front of ventrals only. Caudal lobes equal. Head 3½; depth 2½; Lat. l. (scutes) about 30. D. VIII–I, 20; A. II–I, 17. Cape Cod to West Indies; common southward.

(*Scomber hippos* L. Syst. Nat: *Carangus hippos* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 433: *Caranx defensor* Holbrook, Ichth. S. C. 1860, 87: *Caranx caninus* Günther, Trans. Zoöl. Soc. Lond. 1866, 432: *Scomber carangus* Bloch, taf. 340: *Scomber chrysos* Mitchill, Trans. Lit. and Phil. Soc. N. Y. i, 424: *Carangus chrysos* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 434: *Carangus esculentus* Grd. U. S. Mex. Bound. Surv. Ichth. 23: *Caranx carangus* Günther, ii, 448.)

222.—BLEPHARIS Cuvier.

Cobbler-fishes.

(*Gallus* Lacépède, preoccupied: *Scyris*, *Hynnis* and *Gallichthys* Cuv. & Val.: *Blepharichthys* Gill.)

(Cuvier, Règne Anim. ii, 1817: type *Zeus ciliaris* Bloch.)

Body rhomboid, deep, strongly compressed, more or less completely covered with minute embedded scales, sometimes apparently naked; those on the straight portion of the lateral line enlarged, bony and spinous, as in *Caranx*, but less developed. Mouth moderate, with bands of villiform teeth on jaws, vomer, palatines, and tongue. First dorsal fin little developed, the spines short and rudimentary, mostly disappearing with age; soft dorsal and anal similar to each other; the first five or six rays of each fin elongate and filiform in the young, becoming shorter with age; ventral fins elongate in young; on finlets. Caudal peduncle narrow; the caudal widely forked. Gill-rakers moderate, stout. This genus is not essentially different from *Caranx*. Warm seas. (βλεφαρος, cilium.)

692. B. crinitus (Akerly) Dekay.

Bluish above, golden yellow below; a dark blotch on opercle; a black spot on orbit above; a black blotch on dorsal and anal in front. Body oval, much compressed, highest at the elevated bases of dorsal and anal fins. Preorbital very deep. Mouth nearly horizontal in the

adult, very oblique in the young. First rays of dorsal and anal filamentous, exceedingly long, becoming shorter with age. Lateral line with a wide arch, the curved portion about equal to straight. Scaly sheath of fins little developed. Scutes become stronger and blunter with age. Ventrals broad. Occipital keel sharp. Pectorals long and falcate, longer than head. Head $3\frac{1}{3}$ in length; depth $1\frac{1}{4}$ to 2. D. VI–I, 19; A. II–I, 16. Scutes 12. Cape Cod to South America; not very abundant northwards.

(*Zeus crinitus* Akerly, Amer. Jour. Sci. xi, 144; Dek. N. Y. Fauna, Fish. 123: *Caranx sutor* Günther, ii, 454.)

223.—SELENE Lacépède.

Moon fishes.

(*Argyriosus* Lacépède: *Vomer* Cuvier.)

(Lacépède, Hist. Nat. Poiss. iv, 560, 1803: type *Selene argentea* Lac.)

Body very closely compressed and much elevated, the profile very oblique or nearly vertical; edges of body everywhere trenchant, especially anteriorly. Head short and very deep, the opercle very short, and the preorbital extremely deep; an abrupt angle at the occipital region. Mouth rather small; premaxillaries protractile, fitting into a notch between the bases of the maxillaries; maxillaries broad, each with a supplemental bone. Tongue narrow, free. Teeth minute, on jaws, tongue, vomer, and palatines. Gill-rakers long and slender. Spines of fins usually weak, more or less filamentous in the young; free anal spines immovable, sometimes obsolete in the adult. Soft fins falcate or not. No finlets. Head naked. Scales minute. Lateral line unarmed. Coloration silvery. (σελήνη, the moon.)

a. Soft dorsal and anal with the anterior rays much produced in the adult. (*Selene.*)

693. S. vomer (L.) Lütken.—*Moon-fish; Look Down; Horse-head.*

Bluish above, sides and below silvery with golden reflections; anterior edge of soft dorsal black; axil dusky. Diameter of eye, length of opercle, and distance from eye to profile about equal; eye 2 in maxillary, $2\frac{1}{2}$ in preorbital; mandibles very deep, the dentary bones thin, approximate; one or two of the dorsal spines greatly elongate and filamentous in the young, short in the adult; ventrals variable in length, usually about as long as the eye in the adult, variously elongate in partly grown specimens. Head 3 in length; long dorsal rays 2; pectoral $2\frac{3}{4}$; long anal rays $2\frac{2}{3}$; depth $1\frac{1}{2}$. D. VII–I, 22; A. II–I, 20. Warm seas; rather common southward, north to Long Island, and Lower California.

(*Zeus vomer* Linn. Syst. Nat.: *Zeus capillaris* Mitch. Trans. Lit. & Phil. Soc. N. Y.

1815, 383: *Argyriosus vomer* Günther, ii, 458: *Selene argentea* Lacépède, iv, 560: *Argyreiosus pacificus* Lockington, Proc. Cal. Acad. Nat. Sci. 1876: *Selene argentea* (adult) and *Argyriosus vomer* (partly grown) of most recent writers. Lütken, Spolia Atlantica, 1880, 547, in which memoir the stages of growth of this and other species are fully described.)

aa. All the fins very low, none of the rays produced or filamentous in the adult. (*Vomer** Cuvier.)

694. S. setipinnis (Mitch.) Lütken.—*Horse Fish.*

Greenish above, below golden or silvery. Young with a black blotch at origin of straight part of lateral line. Body oblong, rhombic, less elevated than in the other species; profile anteriorly nearly vertical, highest above the eye, snout somewhat protruding, belly most arched in the young; mouth oblique; maxillary reaching vertical from front of orbit. Ventral fins minute; dorsal and anal very low, especially in the adult, the long rays disappearing very early; pectorals falcate, about as long as head. Head $3\frac{1}{4}$ in length; depth $1\frac{5}{6}$. D. VIII–I, 21; A. II–I, 17. Tropical America, north to Cape Cod; not very common on our coasts.

(*Zeus setapinnis* Mitch. Trans. Lit. & Phil. Soc. N. Y. 1815, 384: *Argyreiosus setipinnis* Günther, ii, 459: *Vomer browni* Cuv. & Val. ix, 189: *Vomer browni* Dekay, New York Fauna, Fish. 127; Lütken, Spolia Atlantica, 1880, 543: *Vomer curtus* Cope, Proc. Acad. Nat. Sci. Phila. 1870, 119: *Argyreiosus unimaculatus* Batchelder.)

224.—CHLOROSCOMBRUS Girard.

(*Micropteryx* Agassiz, preoccupied.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1858, 168: type *Seriola cosmopolita* Cuv. & Val. = *Scomber chrysurus* L.)

Body oblong ovate, closely compressed, but not elevated; the abdomen prominent anteriorly, its curve being much greater than the curve of the back. Occiput and thoracic region trenchant. Caudal peduncle very narrow, the fin widely forked. Scales small, smooth. Lateral line arched in front, unarmed. Head nearly naked. Preorbital low. Mouth rather small, oblique, lower jaw scarcely projecting; upper jaw protractile; maxillary broad, emarginate behind, with a large supplemental bone. Jaws, vomer, and palatines with feeble teeth, mostly in single series. First dorsal of feeble spines, connected by membrane; second dorsal and anal long and low, similar, much longer than the short abdomen. No finlets. Anal spines strong. Ventrals small; pectorals falcate. Gill-rakers long. (χλωρος, green; σκόμβρος, mackerel.)

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* Cuvier, Régne Anim. ii, 1817: type *Vomer browni* Cuv. = *Zeus setipinnis* Mitchill: (Latin *vomer*, a plowshare.)

695. C. chrysurus (L.) Gill.

Greenish above, sides and below golden; caudal peduncle dusky above; dark opercular and axillary spots; inside of mouth black. Head rather deeper than long; opercles very short; snout short. Mouth very oblique; maxillary reaching anterior margin of eye; eye very large, longer than snout, about 3 in head. Caudal peduncle longer than deep, its diameter less than that of the eye; ventrals very small, fitting into a groove in which the vent is situated; pectorals long, falcate, one-third the length. Head $3\frac{3}{4}$ in length; depth $2\frac{1}{3}$. D. VIII—I, 26; A. II—I, 26. Cape Cod to Lower California and India; common on our South Atlantic coast.

(*Scomber chrysurus* Linn. Syst. Nat.: *Micropteryx chrysurus* Günther, ii, 460: *Seriola cosmopolita* Cuv. & Val. ix, 219: *Seriola chloris* Holbrook, Ichth. S. C. 1860, 79: *Chloroscombrus cariblæus* Grd. Ichth. U. S. Mex. Bound. Surv. 21.)

225.—TRACHYNOTUS Lacépède.

Pompanos.

(*Bothrolæmus* Holbrook: *Doliodon* Girard.)

(Lacépède, Hist. Nat. Poiss. ii, 1800: type *Chætodon glaucus* Bloch.)

Body compressed, moderately elevated, the general outline ovate. Caudal peduncle short and rather slender. Abdomen not trenchant, shorter than the anal fin. Head moderately compressed, very blunt, the snout abruptly truncate. Mouth nearly horizontal, the maxillary reaching the middle of the eye; premaxillaries protractile; maxillary without distinct supplemental bone. Jaws, vomer, and palatines with bands of villiform teeth, which are deciduous with age. Preopercle entire in the adult. Gill-rakers short. Gill-membranes considerably united. Spinous dorsal represented by six rather low spines, which are connected by membrane in the young and are free in the adult. In old specimens the spines appear small on account of encroachments of the flesh, and ultimately often disappear. Second dorsal long, elevated in front; anal opposite to it and similar in form and size; two stout, nearly free spines in front of anal, and one connected with the fin, these often disappearing with age. Scales small, smooth. Lateral line unarmed, little arched; no caudal keel. "When extremely young the preoperculum is armed at the angle with three large spines, and smaller ones above and below. The spinous dorsal is developed as a perfect fin, and teeth are present on the jaws and palatine arch. In this stage the species has never been described by previous naturalists, and consequently has received no name, as the corresponding stage of *Naucrates* (*Nauclerus*) has. At an

early period the preopercular spines are absorbed into the substance of the preoperculum and disappear. The spinous dorsal and the teeth are still retained. In this condition it remains for some time, the spinous dorsal, however, gradually losing its relative size, while the soft vertical fins increase. In this stage the species belongs to the genus *Doliodon* of Girard. At a later period the membrane connecting the dorsal spines has become obsolete, and the species then represents the genus *Trachynotus*, as understood by Cuvier and Valenciennes, and others. Finally, in old age, the teeth of the jaws, palate, and pharyngeal bones have fallen out, and the lobes of the dorsal, anal, and caudal fins attained their greatest extension and become pointed. This final stage has been made known by Holbrook under the new generic name of *Bothrolæmus*" (Gill, Proc. Acad. Nat. Sci. Phila. 1862, 440). The pseudobranchiæ also disappear in old specimens. The species of *Trachynotus* are among those most highly valued as food-fishes. (τραχύς, rough; νῶτος, back.)

a. Body without dark bands.

b. Vertical fins without black.

696. T. carolinus (L.) Gill.—*Common Pompano.*

Uniform bluish above, sides silvery, golden in the adult, without bands; fins plain silvery or dusky. Body oblong ovate, elevated, profile forming a gentle curve from the middle of the back to the snout, where it descends abruptly. Dorsal and anal falcate, their lobes reaching when depressed nearly to the middle of the fin; pectoral reaching to opposite the vent. Gill-rakers short, slender in the young, becoming thick in the adult. Head 4; depth $2\frac{1}{3}$. D. VI–I, 25; A. II—I, 23. L. 18 inches. West Indies, north to Cape Cod; the most valued food-fish of our southern waters.

(*Gasterosteus carolinus* Linn. Syst. Nat.: *Trachynotus pampanus* Günther, ii, 484; *Bothrolæmus pampanus* Holbrook, Ichth. S. C. 1860, 81.)

bb. Vertical fins largely black.

697. T. ovatus (L.) Gthr.

Bluish, sides silvery; lobes of the dorsal and anal more or less black. Body comparatively deep. Head about 4. Depth $1\frac{3}{4}$ to 2. D. VI–I, 19; A. II—I, 18. In all warm seas; north to Virginia on our Atlantic coast.

(*Gasterosteus ovatus* L. Syst. Nat.; Günther, ii, 481.)

698. T. goreensis C. & V.

Dorsal, anal, and caudal lobes black. Snout obliquely truncated; maxillary reaching to below the centre of the eye; anterior rays of dor-

sal and anal extending beyond the middle of the fins when depressed. Head $4\frac{1}{2}$ in total length; depth, $2\frac{3}{4}$; caudal lobes 4. D. VI—I, 20; A. II–I, 17. Florida to Africa. (*Günther.*) Not evidently different from the preceding.

(Cuv. &. Val. viii, 419; Günther, ii, 483.)

aa. Body with vertical dark bands.

699. T. glaucus Cuv. & Val.

Bluish, sides golden, with four narrow blackish vertical bands, the first under the first dorsal spine, the second under the fifth, the others under the soft dorsal. Dorsal and anal fins falcate, much elevated anteriorly, reaching beyond base of caudal; caudal lobes elongate. Head $3\frac{3}{4}$; depth 2. D. VI–I, 19; A. II–I, 18. Pyloric cœca 13. Tropical seas, north to Virginia and Lower California.

(Cuv. & Val. viii, 400; Günther, ii, 483; Holbrook, Ichth. S. C. 192.)

226.—NAUCRATES Rafinesque.

Pilot-fishes.

(*Nauclerus* Cuvier; young.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi, &c., 1810, 44: type *Naucrates conductor* Raf. = *Gasterosteus ductor* L.)

This genus differs from *Seriola* only in the reduction of the spinous dorsal to a few (4 or 5) low, unconnected spines. The young (*Nauclerus* Cuv.) have the spines of the dorsals connected by membrane, and a more or less distinct strong spine at the angle of the operculum. A single species, in the open seas. (ναυκράτης, ruler of the ships, *i. e.* holding ships fast—a name applied by the ancients to *Echeneis* and other fishes.)

700. N. ductor (Linn.) Raf.—*Pilot-fish; Romero.*

Bluish, with five to seven dark vertical bars. Body rather elongate, little compressed. Snout rather blunt. Mouth terminal, oblique, small; maxillary scarcely reaching orbit. Caudal keel large, fleshy; pectorals short and broad; ventrals rather large. Head 4 in length; depth 4. D. IV—I, 26; A. II—I, 16. In all warm seas; occasional on our Atlantic coast.

(*Gasterosteus ductor* Linn. Syst. Nat.: *Naucrates noveboracensis* Cuv. & Val. viii, 325; Günther, ii, 374.)

227.—SERIOLA Cuvier.

Amber-fishes.

(*Halatractus* Gill.)

(Cuvier, Règne Anim. ed. 2, ii, 1829: type *Caranx dumerili* Risso.)

Body oblong, moderately compressed, not elevated. Occiput and breast not trenchant. Head usually more or less conical, not very blunt. Mouth comparatively large, with broad bands of villiform teeth on both jaws, tongue, vomer, and palatines; a broad, strong, supplemental maxillary bone; premaxillaries protractile. Scales small. Lateral line scarcely arched, forming a keel on the caudal peduncle, not armed with bony plates. Sides of head with scales. First dorsal with about seven low spines, connected by membrane; second dorsal very long, elevated in front; anal similar to the soft dorsal but not nearly so long, shorter than the abdomen, preceded by two very small free spines, which disappear in old fishes; no finlets; ventral fins very long; pectorals short and broad. Gill-rakers moderate. Species of moderate or large size, often gracefully colored; most of them valued as food-fishes. This genus should probably be united to *Naucrates*. (*Seriola*, the Italian name of *S. dumerili*.)

701. S. lalandi Cuv. & Val.—*Yellow-tail.*

Bright steel-blue above, sides dull silvery, an irregular yellowish lateral band; fins dusky yellowish green; caudal dull yellow. Body regularly fusiform, somewhat compressed, tapering to the sharp snout and slender caudal peduncle. Maxillary reaching front of pupil. Mouth not very large. Gill-rakers long and strong. Head naked, except on the cheeks. Fins scaleless. Caudal keel moderate; caudal lobes nearly equal. Spines of moderate development, the free anal spines disappearing with age. Pectorals shorter than ventrals, which are half length of head; longest dorsal ray $\frac{2}{5}$ height of body. Pyloric cœca very numerous. Head 4; depth 4. D. V to VII–I, 35; A. II–I, 21. L. 3 feet. In most warm seas; abundant in summer about the Santa Barbara Islands; also occasional on the South Atlantic coast. An excellent food-fish.

(Cuv. & Val. ix, 208, 1833; Günther, ii, 463: *Seriola aureovittata* Schlegel, Faun. Japan. Poiss. 115, pl. 62.)

702. S. rivoliana Cuv. & Val.—*Rock Salmon.*

Color uniform; an oblique black band from the nape through the eye to the preorbital. Snout conical, $1\frac{1}{2}$ times the diameter of the eye. Maxillary not reaching the vertical from centre of pupil. Back, neck, and

abdomen slightly compressed. Ventrals reaching vent; soft dorsal falcate, its height 6 in length. Scales small. Depth $3\frac{3}{4}$; head 4. D. VII, I, 29; A. II, I, 21; Lat. l. about 131. (*Günther.*) Coast of Brazil to Florida.

(Cuv. & Val. ix, 207: *Seriola bonariensis* Günther, ii, 464: *Seriola bonariensis* Goode & Bean, Proc. U. S. Nat. Mus. ii, 1879, 129: ? *Seriola bosci* * Cuv. & Val. ix, 209: Lütken, Spolia Atlantica, 1880, 603: *Seriola falcata* Günther, ii, 464.)

703. S. stearnsii Goode & Bean.

Color bluish above, whitish beneath, a band of greenish yellow as wide as the eye extending from the preopercle to the extremity of the tail; fins greenish; traces of bands on the opercle. Body subfusiform, highest at origin of second dorsal, thence tapering evenly to snout and tail. Caudal peduncle somewhat depressed, with lateral carinæ and strong transverse grooves above and below; maxillary reaching vertical from middle of orbit. Teeth villiform in jaws, on vomer, palatines, and in one median and two lateral series on tongue. Scales small on the cheeks, none on limb of preopercle or the remainder of the head. Head $3\frac{1}{2}$ in length; depth $4\frac{2}{3}$. Eye $6\frac{1}{3}$ in head. D. VII–I, 36; A. II–I, 19. (*Goode & Bean.*) Gulf of Mexico, north to Pensacola.

(Goode & Bean, U. S. Nat. Mus. 1879, 48.)

704. S. zonata (Mitch.) C. & V.—*Rudder Fish.*

Bluish above, white below; sides with about 6 broad black bars, the forming three large blotches on the dorsal and two on the anal; the bars growing faint or disappearing with age; an oblique dark band from the spinous dorsal to the eye, the space above this olivaceous; spinous dorsal black; ventrals mostly black. Head longer than deep; profile descending in a gentle curve; top of head to base of dorsal fin compressed. Mouth nearly horizontal; maxillary reaching to below the middle of orbit. Pectorals small, rounded, as long as the eye and snout; ventrals two-thirds length of head. Vent behind middle of body. Head $3\frac{1}{2}$ in length; depth, $3\frac{1}{3}$. D. VII–I, 38; A. II–I, 21. L. 30 inches. Cape Cod to Florida; rather common.

(*Scomber zonatus* Mitch. Trans. Lit. and Phil. Soc. N. Y. 1815, 427; Günther, ii, 465: *Seriola carolinensis* Holb. Ichth. S. C. 1860, 72; from South Carolina, wants the vertical bands, but is not otherwise obviously different; this is doubtless due to increased age, as Holbrook's type was over two feet in length.)

705. S. fasciata (Bloch) Cuv. & Val.

Greenish above, yellow below; body with sixteen narrow and somewhat irregular brown cross-bands, arranged in pairs; those between

* Body deeper, eye larger, spines stouter, and caudal broader than in *S. dumerili.* D. VII–I, 31; A. II–I, 20. Silvery with a brown temporal band. South Carolina. (*Cuv. & Val.*)

the soft dorsal and anal extend on those fins, forming five blotches on the former and three on the latter; a blackish band between the eyes; ventrals black. Head short, deeper than long; profile convex. Dorsal and anal fins not elevated. D. VII–I, 30; A. II, 20. (*Cuv. & Val.*) Coast of South Carolina.

(*Scomber fasciatus* Bloch. Ichth. taf. 341; Günther, ii, 464; Cuv. & Val. ix, 211: *Zonichthys* fasciatus* Swainson, Class. Fish. 1839, 248.)

228.—ELAGATIS Bennett.

Yellow Tails.

(*Seriolichthys* Bleeker: *Decaptus* Poey.)

(Bennett, Narrative of a whaling voyage, ii, 283, 1840: type *Seriola bipinnulata*, Quoy & Gaimard.)

Second dorsal and anal long, each with one detached finlet composed of two rays. Otherwise as in *Seriola*. (ἠλἄκάτη, a spindle.)

706. E. pinnulatus Poey.

Bluish, with two longitudinal bluish bands, yellowish below. Body fusiform, very elongate. Cheeks scaly. Maxillary reaching a little beyond nostrils. Eyes $7\frac{1}{2}$ in head. Caudal keel feeble; caudal lobes very long. Pectorals pointed, half as long as head. Fins not scaly. Two rays connected by membrane in each finlet. Head $4\frac{3}{4}$; depth $5\frac{1}{2}$. D. VI–I, 26–II; A. II–I, 17–II. L. $2\frac{1}{2}$ feet. (*Poey.*) West Indies, north to Florida; rare.

(*Seriola pinnulata* Poey, Memorias, ii, 233, 1858.)

229.—SCOMBEROIDES Lacépède.

Leather-jackets.

(Lacépède, Hist. Nat. Poiss. iii, 52, 1802: type *Scomberoides noeli* Lac.)

Body compressed, oblong or lanceolate. Caudal peduncle slender, not keeled. Head short, compressed, acute. Occipital keel sharp. Mouth rather large, with small sharp teeth in bands on jaws, tongue, vomer, and palatines, and sometimes on the pterygoids. Jaws about equal, the upper not protractile; maxillary very narrow, without distinct supplemental bone. Gill-rakers rather long. Scales small in our species, linear, and extremely narrow, embedded in the skin at different angles. Lateralline unarmed. Dorsal spines rather strong, 3 to 7 in number, nearly free in the adult; second dorsal very long, its posterior rays pencillated and nearly or quite disconnected, forming finlets; anal

* The genus *Zonichthys* Swainson, l. c., based on this species is characterized by the deep head, its depth at the occiput being greater than its length. (ζονος, zone; ἰχθύς, fish.)

rather longer than soft dorsal, much longer than the abdomen, its last rays forming similar finlets; anal spines strong; ventral fins depressible in a groove; pectoral fins very short. Species numerous in the tropical seas. The American species belong to the subgenus or genus *Oligoplites*, characterized by the toothless pterygoids and the peculiar scales. The dorsal spines are seven in *Scombroides* proper (*Chorinemus* Cuvier), the pterygoids are armed with teeth, and in most of the species the scales are normally developed. (σκομβρος, mackerel; ειδος, like.)

a. No pterygoid teeth; scales linear, embedded (*Oligoplites** Gill.)

707. S. occidentalis (Linn.) J. & G.—*Leather-jacket.*

Bluish above, bright silvery below; fins yellow. Body lanceolate, slender. Eye as long as snout, about 4 in head; opercles short. Maxillary reaching beyond middle of orbit. Scales very long and narrow, embedded in the skin, placed obliquely at angles with each other, their appearance unlikeordinary scales. Fins low; pectoral as long as eye and snout; caudal very deeply forked, the lobes equal. Head 5 in length; depth 4. D. V, I,20; A. II—I, 20. Both coasts of Central America, and West Indies, north to New York and Lower California; not rare southward.

(*Gasterosteus occidentalis* Linn. Syst. Nat.: *Chorinemus occidentalis* Günther, ii, 475; *Oligoplites occidentalis* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 166.)

Family LXXVI.—POMATOMIDÆ.

(*The Blue-fishes.*)

Body oblong, compressed, covered with rather small scales, which are weakly ctenoid. Caudal peduncle rather stout. Head large, compressed. Mouth large, oblique. Premaxillaries protractile. Maxillary not slipping under the preorbital, provided with a large supplemental bone; lower jaw projecting; bands of villiform teeth on vomer and palatines, those on the vomer forming a triangular patch; jaws each with a single series of very strong, compressed, unequal teeth, widely set; upper jaw with an inner series of small depressed teeth; villiform teeth on the base of the tongue. Occipital keel strong; free edge of preopercle produced and serrated. Gill-membranes free from the isthmus, not united. Branchiostegals 7; gills 4, a slit behind the fourth. Pseudobranchiæ large. Gill-rakers slender, rather few. Opercle ending in a flat point. Cheeks and opercles scaly. Lateral line present, unarmed. Dorsal

*Gill. Proc. Acad. Nat. Sci. Phila. 1863, 166: type *Gasterosteus occidentalis* L. (ολιγος, few; ὁπλίτης, armed.)

fins 2, the anterior of about 8 weak, low spines, connected by membrane and depressible in a groove; second dorsal long, similar to the elongate anal, both fins being densely scaly; fin-rays slender. Two very small, free, anal spines, sometimes hidden in the skin. Ventrals thoracic, I, 5. Pectorals rather short. Caudal fin forked, the lobes broad. Air-bladder simple, with thin walls. Pyloric cœca very numerous. Vertebræ 10 + 14, as in *Carangidæ*. A single species, found in nearly all warm seas. This family is closely related to the *Carangidæ*, from which group it is an offshoot toward the Percoids.

(*Carangidæ*, genus *Temnodon* Günther, ii, 479–480.)

230.—POMATOMUS Lacépède.

Blue-fish.

(*Temnodon* Cuvier.)

(Lacépède, Hist. Nat. Poiss. iv, 436, 1802: type *Pomatomus skib* Lac. = *Gasterosteus saltatrix* L.)

Characters of the genus included above. (πῶμα, operculum; τομός, cutting; from the serrated preopercle.)

708. P. saltator (L.) Gill.—*Blue-fish; Green-fish; Skip-jack.*

Bluish or greenish, silvery below; a black blotch at base of pectoral. Body robust, moderately compressed; belly compressed to a bluntish edge. Head deep; top of head and a ridge on each side above the cheeks naked. Cheeks much longer than the opercles. Pectorals placed rather low, their length a little more than half that of the head. Head $3\frac{1}{3}$; depth 4. D. VIII–I, 25; A. II–I, 26; Lat. l. 95. L. 3 feet. Atlantic and Indian Oceans; of late years very abundant on our Atlantic coast; a large, voracious fish, extremely destructive to other fishes; valued for food.

(*Perca saltatrix* L. Syst. Nat. xi, 1760, i, 293: *Gasterosteus saltatrix* L. Syst. Nat. xii, 1766: *Temnodon saltator* Cuv. & Val. ix, 225: *Temnodon saltator* Storer, Hist. Fish. Mass. 360: *Temnodon saltator* Günther, ii, 479.)

Family LXXVI (*b*).—NOMEIDÆ.

(*The Nomeids.*)

Scombroid fishes with the body oblong, more or less compressed, covered with cycloid scales of moderate size. Vertebræ more than 10 + 14, as in *Scombridæ* and *Stromateidæ*. Mouth large or small, usually with minute teeth; premaxillaries protractile; maxillary narrow. Gill-membranes separate, free from the isthmus; pseudobranchiæ large. No tooth-like processes in the œsophagus. Preopercle entire, or crenu-

late. Lateral line unarmed. Ventrals thoracic, I, 5, sometimes depressible in a deep groove in the abdomen. Dorsal fins separate; the spines usually feeble, connected by membrane. Soft dorsal long, sometimes with finlets; anal fin similar to soft dorsal, without free spines; caudal peduncle slender, the fin widely forked. Pyloric cœca numerous. Genera 5; species about 10. Fishes of the tropical seas.

(*Scombridæ*, group *Nomeina* Günther, ii, 387–392.)

a. Cleft of mouth narrow; ventrals received in a deep groove in the abdomen.

231.—NOMEUS Cuvier.

(Cuvier, Règne Anim. 1817: type *Gobius gronovii* Gmelin.)

Body oblong, rather compressed, covered with rather small cycloid scales. Head flattish above; occipital crest little developed; cleft of the mouth narrow. Teeth small, in a single series in the jaws; teeth on the vomer and palatines. Pseudobranchiæ large. First dorsal with 10 or 11 spines; second dorsal and anal very long, similar to each other, without finlets; anal fin with 3 rather strong spines, none of them free; caudal fin not deeply forked; ventral fins long and broad, attached to the belly by a membrane, depressible in a deep furrow in the abdomen. Lateral line running high. Air-bladder present. Pyloric cœca very numerous. Vertebræ 16 + 25. Warm seas. (νομεὺς, pastor; early travellers having compared the fish to a mullet, *herder* or *berger* in Dutch.)

709. N. gronovii (Gmel.) Gthr.

Brownish above, silvery below, the sides below with large round brown spots; ventrals black, with silvery edgings; anal with 3 brown spots. Maxillary reaching to below the front of the eye; ventrals reaching front of anal, pectorals still further. D. X–I, 26; A. III, 26. Tropical parts of the Atlantic and Indian Oceans; north to Florida.

(*Gobius gronovii* Gmelin, Syst. Nat. 1788, 1205: *Nomeus mauritii* Cuv. & Val. ix, 243: Günther, ii, 387.)

FAMILY LXXVII.—STROMATEIDÆ.

(*The Broad Shiners.*)

Scombroid fishes, with the body compressed and more or less elevated, covered with small or minute cycloid scales. Profile anteriorly blunt and rounded. Mouth small. Premaxillaries protractile or not. Dentition feeble; no teeth on vomer or palatines; œsophagus armed

with numerous horny, barbed or hooked teeth. Gills 4, a slit behind the fourth. Gill-membranes either free or more or less joined to the isthmus. Gill-rakers rather long. Pseudobranchiæ present. Cheeks scaly. Preopercle entire or serrate. Lateral line well developed. Dorsal fin single, long, with the spines few or weak, often obsolete; anal fin long, similar to the soft dorsal, usually with three small spines, which are often depressible in a fold of skin; ventrals thoracic or jugular, normally I, 5, but sometimes reduced or altogether wanting; caudal fin lunate or forked. Usually no air-bladder. Pyloric cœca commonly numerous Vertebræ more than 10 + 14. Genera about 5; species 25–30. Small fishes, found in most warm seas. The two subfamilies, both represented in our waters, differ widely from each other in general appearance, but agree in the singular character of teeth in the œsophagus.

(*Scombridæ* and *Carangidæ*, pt. Günther, ii, 397–404, 485. Genera *Stromateus*, *Centrolophus*, and *Pammelas*.)

* Ventral fins minute or absent; opercular bones entire; scales minute; caudal fin forked; premaxillaries not protractile. (*Stromateinæ*.)

a. Caudal peduncle not keeled; gill-membranes free from the isthmus.

STROMATEUS, 232.

** Ventral fins well developed; V. I, 5; scales moderate; premaxillaries protractile; caudal lunate. (*Centrolophinæ*.)

b. Dorsal spines short and stout; preopercle, interopercle, and subopercle finely serrate ..... LIRUS, 233.

232.—STROMATEUS Linnæus.

Harvest Fishes.

(*Peprilus* and *Rhombus* Cuvier: *Poronotus* Gill.)

(Artedi; Linnæus, Syst. Nat.: type *Stromateus fiatola* L.)

Body ovate or suborbicular, strongly compressed, tapering into a slender caudal peduncle, which is not keeled or shielded. Head short, compressed, the profile obtuse. Mouth small, terminal, the jaws subequal. Premaxillaries not protractile. Jaws each with a single series of weak teeth. Scales very small, cycloid, silvery, loosely inserted, extending on the vertical fins. Opercular bones entire. Gill-membranes separate, free from the isthmus; gill-rakers moderate. Lateral line continuous, concurrent with the back. Dorsal fin long, more or less elevated in front, preceded by a few indistinct spines—usually one or more procumbent spines in front of dorsal and anal, each of these with a free point both anteriorly and posteriorly; anal fin similar to dorsal, or shorter, usually with three small spines; ventral fins wanting in the adult, a rudiment sometimes visible in the young; a single small,

sharp spine, attached to the pubic bone, often occupying the place of the ventrals; pectorals long and narrow. Caudal widely forked. Species numerous. (*στρῶματεος*, an ancient name of some brightly colored fish in the Red Sea; from *στρῶμα*, a bed-quilt.)

a. Ventral fins obsolete; pelvic spine present.

b. Dorsal and anal fins falcate, their anterior rays much longer than the head; body suborbicular. (*Rhombus** Lacépède.)

710. S. alepidotus (L.) J. & G.—*Harvest Fish.*

Greenish above, golden-yellow below. Body suborbicular, bounded by even curves. Mouth very small, oblique, maxillary reaching front of orbit. No pores along the sides of the back. Pectorals shorter than head, reaching half way to caudal; soft dorsal and anal fins falcate, the longest rays of anal nearly half length of body; caudal lobes equal Scales thin and deciduous, not very small. Head 3; depth $1\frac{1}{3}$. D. 45; A. 40; Lat. l. about 90. Vertebræ 15 + 15. Cape Cod to South America; commonest southward.

(*Chætodon alepidotus* L. Syst. Nat.: *Sternoptyx gardenii* Bl. & Schn. 1801, 494: *Rhombus longipinnis* Cuv. & Val. ix, 401: *Stromateus gardenii* Günther, ii, 399.)

bb. Dorsal and anal fins not falcate, their anterior rays shorter than the head; form ovate.

c. No series of large pores along the sides of the back.

711. S. simillimus Ayres.—*California Pompano.*

Bluish above, brightly silvery below; fins punctulate; anterior lobes of dorsal and anal dusky-edged. Body ovate, blunt anteriorly, with a short, slender tail, the caudal fin widely forked. Mouth very small, terminal, the maxillary extending to the eye. Teeth very feeble. Gill-rakers short, slender, less than half diameter of eye. Eye small. One or 2 procumbent spines before the dorsal; longest rays of dorsal $\frac{3}{4}$ of head; pubic spine small; pectorals longer than head; no pores along base of dorsal. Spines of dorsal and anal very small or entirely obsolete. Scales small, silvery, deciduous. Head 4; depth 2. D. III, 46; A. III, 40. L. 10 inches. Pacific coast of United States; abundant in summer; highly prized as a food-fish.

(*Poronotus simillimus* Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 84.)

cc. A series of large pores along the base of the dorsal fin. (*Poronotus*† Gill.)

712. S. triacanthus Peck.—*Dollar-fish; Harvest-fish; Butter-fish; La Fayette.*

Bluish above, below silvery. Body oval, much compressed. Dorsal

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* Lacépède, Hist. Nat. Poiss. ii, 321, 1800: type *Chætodon alepidotus* L. (*ῥομβος*, rhomb.)

†Gill, Cat. Fish. East Coast N. Am. 1861, 35 (not characterized): type *Stromateus triacanthus* Peck. (*πορός*, pore; *νῶτος*, back.)

and ventral outlines about equally curved. Snout very blunt, rounded in profile. Mouth small, the maxillary not reaching the orbit. Caudal peduncle very short; anterior rays of dorsal and anal little elevated. Lateral line high, a series of conspicuous pores above it near the base of the dorsal. Pectorals much longer than head. Gill-rakers rather long, $\frac{2}{3}$ diameter of the eye, which is 4 in head. Head 4; depth $2\frac{1}{3}$. D. III, 45; A. III, 38. L. 10 inches. Maine to Cape Hatteras; very abundant.

(Peck, Mem. Amer. Acad. ii, 48: *Rhombus cryptosus* Cuv. & Val. ix, 408; Günther, ii, 398.)

233.—LIRUS Lowe.

Rudder-fishes.

(*Palinurus* DeKay, preoccupied in Crustacea: *Palinurichthys* Gill: *Pammelas* Günther.)

(*Leirus* Lowe, Proc. Zoöl. Soc. Lond. 1839, 82: type *Leirus bennetti* Lowe = *Centrolophus ovalis* C. & V.)

Body ovate, compressed, more elongate and less compressed than in *Stromateus*. Profile very blunt and convex. Mouth moderate; maxillary narrow, with a small supplemental bone; premaxillaries protractile, little movable. Jaws nearly equal, each with about one series of small, slender teeth; no teeth on vomer or palatines. Preoperculum, interoperculum, and subopercular finely serrated. Gill-rakers long; gill-membranes separate, free from the isthmus. Scales small, smooth; larger, thicker, and more adherent than in *Stromateus*. Cheeks scaly. Fins rather low; dorsal fin long, preceded by 6–8 short but rather strong spines, the last ones connected by membrane, the others nearly free; anal fin similar but shorter, preceded by 3 spines, which, like the dorsal spines, are nearly imbedded in thick skin; vertical fins densely scaly towards their bases; caudal fin emarginate; caudal peduncle stout; ventral fins large, thoracic, I, 5; pectoral fins moderate, rounded or falcate. Two species, differing from the European genus *Centrolophus* chiefly in the development of the dorsal spines, which in the latter genus are indistinguishable from the soft rays. (λειρος, thin.)

713. L. perciformis (Mitch.) J. & G.—*Rudder-fish.*

Blackish green, everywhere dark, the belly scarcely paler and not silvery. Eye rather large, with an adipose eyelid, its diameter nearly equal to the snout, $4\frac{1}{2}$ in head. Maxillary reaching to opposite front of pupil. Top of head naked, covered with small mucous pores. Pectorals nearly as long as head. Head $3\frac{1}{3}$; depth $2\frac{1}{2}$. D. VII, I, 21; A.

III, 16; Lat. l. 75. L. 1 foot. Maine to Cape Hatteras; rather common northward.

(*Coryphæna perciformis* Mitch. Amer. Month. Mag. ii, 1818, 244: *Palinurus perciformis* DeKay, New York Fauna, Fish. 1842, 118: *Palinurichthys perciformis* Gill, Proc. Acad. Nat. Sci. Phila. 1860: *Pammelas perciformis* Günther, ii, 485.)

Family LXXVIII.—LAMPRIDIDÆ.

(*The Opahs.*)

Body ovate, compressed, and elevated, covered with minute, very deciduous, cycloid scales. Head small, rather pointed. Mouth small, terminal, without teeth, its angle with slits in the skin to permit the motion of the jaws, as in *Orcynus*. Premaxillaries protractile. Opercular bones entire. Dorsal fin single, very long, elevated, and falcate in front, without distinct spines; anal long and low, not at all falcate; both fins depressible in a groove; ventral fins thoracic, but behind the pectorals, composed of 14 to 17 rays; pectoral fins large, falcate, their bases horizontal; caudal fin moderately forked, its peduncle short and slender, without keel. Lateral line present, much arched in front. Branchiostegals 6. Gill-membranes free from the isthmus. Œsophagus not armed with spinous teeth. Air-bladder large, bifurcate behind. Pyloric appendages very numerous. Vertebræ 45. Fishes of large size and gorgeous coloration, inhabiting the open Atlantic. A single genus with one or two species.

(*Scombridæ*, genus *Lampris*, Günther ii, 415, 416.)

234.—LAMPRIS Retzius.

Opahs.

(Retzius, Nya Handlung, iii, 91, 1799: type *Zeus guttatus* Brünnich = *Zeus luna* Gmelin.)

Characters of the genus included above. (λαμπρός, radiant.)

714. L. guttatus (Brünnich) Retz.—*Opah; King-fish; Sun-fish.*

Color a rich brocade of silver and lilac, rosy on the belly; everywhere with round silvery spots; head, opercles and back with ultramarine tints, jaws and fins vermilion; flesh red. Longest dorsal ray shorter than pectorals, which are nearly as long as the head. Anal very low in front, a little higher behind. Head $3\frac{1}{4}$; depth $1\frac{3}{4}$. D. 54; A. 40; V. 14–17. Vert. 23+22. L. 3–4 feet. (*Lowe.*) Atlantic, occasional off Newfoundland. One of the most gorgeously colored of fishes.

(*Zeus guttatus* Brünnich, Danske. Selsk. Skr. iii, 1788, 398: *Zeus luna* Gmelin, Syst. Nat. 1788, 1225: *Lampris luna* Günther, ii, 416; Cuv. & Val. x, 39: *Lampris lauta* Lowe, Fish. Madeira, 27.)

Family LXXIX.—CORYPHÆNIDÆ.

(*The Dolphins.*)

Body elongate, compressed, covered with small cycloid scales. Cleft of the mouth wide, oblique, the lower jaw projecting. Cardiform teeth in the jaws and on the vomer and palatine bones; a patch of villiform teeth on the tongue; no teeth on the œsophagus. Opercular bones entire. Skull with a crest, which is much more elevated in the adult than in the young. A single, many-rayed dorsal fin, not greatly elevated, extending from the nape nearly to the caudal fin; anal similar, but shorter; both without distinct spines; pectoral fins very short and small; ventrals well developed, thoracic, I, 5, partly received into a groove in the abdomen; caudal fin widely forked. Lateral line present. Gill-membranes free from the isthmus. Branchiostegals 7; no pseudobranchiæ. No air-bladder. Pyloric appendages very numerous. Vertebræ more than 10 + 14. A single genus, with six or eight species. Very large fishes, inhabiting the high seas in warm regions, noted for their brilliant and changeable colors. To this family belongs the Dolphin or Dorade of the ancients, *Coryphæna hippurus* L.

(*Scombridæ:* genus *Coryphæna* Günther, ii, 404–408.)

235. CORYPHÆNA Linnæus.

Dolphins.

(*Lampugus* C. & V.; young or crestless forms.)

(Linnæus, Syst. Nat.: type *Coryphæna hippurus* L.)

Characters of the genus included above. The species are not well known, having been unduly multiplied by authors. (κορύφαινα, the name applied by Aristotle to *Coryphæna hippurus*, from κόρυς, helmet; φαίνω, to show.)

715. C. punctulata (Cuv. and Val.) Gthr.—*Spotted Dolphin.*

Sea-green, silvery below, with scattered black spots on the sides and back; a series of distant rounded spots along the base of the dorsal fin; head with brown stripes. Body elongate, compressed, tapering gently backwards; profile very convex, snout blunt. Mouth large, oblique; maxillary reaching middle of orbit. Pectorals short, falcate; ventrals long and rather narrow. Eye large, nearly as long as snout. Head 4½; depth about 5. "D. 51; A. 25." Warmer parts of the Atlantic, occasional on our coast.

(*Lampugus punctulatus* Cuv. and Val. ix, 327: Günther, ii, 408: ? *Coryphæna equiscti* L. Syst. Nat.)

716. C. sueuri Cuv. & Val.

This species appears to differ from the preceding in the increased number of fin rays. The elevated crest represented in DeKay's figure of his "*C. globiceps*" is a character of very old individuals. "D. 64; A. 26." (*Cuv. & Val.*) "D. 63; A. 29." (*DeKay.*) Atlantic coasts of the United States; rare.

(Cuv. & Val. ix, 302: *Coryphæna globiceps* DeKay, New York Fauna, Fish. 1842, 132.)

Family LXXX.—BRAMIDÆ.

(*The Bramoids.*)

Body oblong or elevated, compressed, covered with cycloid or spinous scales. Mouth wide, oblique; the jaws, vomer, and palatines provided with small teeth. Premaxillaries protractile. Snout more or less obtuse and convex. Dorsal and anal fins very long, both more or less elevated; ventrals thoracic or jugular, the number of rays usually not I, 5. Branchiostegals 7. Pseudobranchiæ present. Pyloric appendages few. Vertebræ more than 10+14. Genera 4; species about 10, inhabiting the open seas.

(*Scombridæ:* genera *Brama*, *Taractes*, and *Pteraclis* Günther, ii, 408–411.)

* Dorsal fin very high, extending from the forehead to the caudal fin, composed of very slender, inarticulate spines; anal fin similar; ventral fins jugular. (*Pteraclinæ.*)

a. Jaws, vomer, and palatines with small teeth; air-bladder very small.

Pteraclis, 236.

236.—PTERACLIS Gronovius.

(Gronovius, Act. Helvet. vii, 44, 1772: type *Coryphæna velifera* Pallas.)

Body compressed, oblong, covered with moderate-sized cycloid, lobate or emarginate scales. Eye large. Dorsal fin very much elevated, extending from the forehead to the base of the caudal, composed of filiform spines, its form triangular, its base scarcely less than the total length of the fish; anal fin similar in form, also composed of slender fragile spines; ventrals jugular, nearly under the eye, long, of 4–6 slender rays. Pseudobranchiæ present. Air-bladder very small. Most of the species of this singular genus inhabit the Indian Ocean. (πτερόν, fin or wing; κλείω, to close. "The name indicating the double rows of scales which embrace the bases of the two vertical fins.")

717. P. carolinus Cuv. & Val.

Silvery, with bluish reflections. Mouth larger, scales larger, and fourth ray of the dorsal stouter than in other species. D. LII; A. LXIV.

Coast of South Carolina; known only from a mutilated specimen 4 inches long, evidently the young of some pelagic species.

(Cuv. & Val. ix, 368; Günther, ii, 411.)

FAMILY LXXXI.—ZENIDÆ.

(*The Dories.*)

Body short, deep, much compressed and elevated, naked, or covered with minute scales, or with bony protuberances. Teeth small, in narrow bands or single series, on the jaws and vomer and sometimes on the palatines. Mouth rather large, terminal, the upper jaw protractile. Eyes lateral. Opercles and other bones about the head often armed with spines. Branchiostegals 7 or 8. Gill-membranes little united, free from the isthmus. Pseudobranchiæ large. Air-bladder large. Gill-rakers usually short. Gills 4, a slit behind the fourth. Dorsal fin emarginate, or divided, the anterior part with strong spines, the posterior part longer; anal fin with or without spines; ventral fins thoracic, their rays I, 5 to I, 8; caudal fin usually not forked. Lateral line obscure, unarmed. Pyloric cœca exceedingly numerous. Vertebræ about 32. Genera 5; species about 10; fishes of singular appearance, inhabiting warm seas.

(*Scombridæ*, group *Cyttina*, Günther, ii, 393–396: *Cyttidæ* Günther, Intr. Study Fish. 450.)

a. Scales minute or wanting; anal spines very strong; no palatine teeth. (*Zeninæ.*)
b. Anal spines 3; bases of both dorsals armed with spinous plates. ZENOPSIS, 237.

237.—ZENOPSIS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 123: type *Zeus nebulosus* Temminck & Schlegel, from Japan.)

Body ovate, much compressed, without scales, not warty. Head deeper than long, its anterior profile steep. Mouth rather large, upper jaw protractile; teeth small, on jaws and vomer, none on the palatines. Various bones of the head and shoulder girdle armed with spines. Series of bony plates along the sides of the belly and the bases of the dorsal and anal, each plate armed with a strong spine. Eye large, placed high. Gill-rakers short. Dorsal spines very strong, usually 10 in number. Anal spines 3. Ventral fins long, mostly I, 7. Caudal peduncle slender, the fin not forked. Two or three species known, differing from *Zeus*, mainly in the presence of 3 anal spines instead of 4. Pelagic. (ζεύς, Zeus; ωψις, appearance. Zeus is from ζεύς, Jupiter.)

718. Z. ocellatus (Storer) Gill.

Color silvery, nearly plain; a black lateral ocellated spot in life, disappearing in spirits. Body short, deep, compressed. Skin wholly naked, except for the bony bucklers, which are armed each with a central spine hooked backwards and marked with radiating ridges; 7 bucklers along the base of the dorsal, the 5th and 6th largest; 2 on the median line in front of the ventrals, the second largest; one median plate, and 6 pairs between ventrals and anal, and 4 along the base of the anal. Top of the head with roughish ridges, but without spines; a spine at the base of each dentary bone; the broad maxillaries each with a supplemental bone; teeth nearly obsolete. Eye large, much nearer the gill opening than the tip of the snout. Gill-rakers short. Caudal peduncle very slender, the caudal fin short and rounded; pectorals very short; ventrals large, the rays I, 6, the first soft ray closely appressed to the spine; anal spines short and stout, the soft rays, like those of the dorsal, low; dorsal spines filamentous. D. IX, 26; A. III, 24. Pelagic; one specimen taken at Provincetown, Mass. (Description from the original type.)

(*Zeus ocellatus* Storer, Proc. Bos. Soc. Nat. Hist. vi, 888; Gill, l. c.)

Family LXXXII.—BERYCIDÆ.

(*The Squirrel-fishes.*)

Body oblong or ovate, compressed, covered with very strongly ctenoid or spinous scales. Head with large muciferous cavities, covered by thin skin. Eye lateral, usually large. Mouth more or less oblique. Premaxillaries protractile; maxillary rather large, usually with a supplemental bone. Bands of villiform teeth on jaws, and usually on vomer and palatines. Opercular bones usually spinous; frequently every membrane bone of the head strongly serrated. Branchiostegals mostly 8. Gill-membranes separate, free from the isthmus. Gills 4, a slit behind the fourth. Pseudobranchiæ present. Gill-rakers moderate. Cheeks and opercles scaly. No barbels. Dorsal fin long or short, usually with strong spines; anal with 2–4 spines; ventral fins thoracic, usually I, 7, the number of rays greater than I, 5; caudal fin usually forked. Pyloric cœca numerous. Genera 5–6; species about 50. Rough-scaled and brightly colored fishes of the warm seas; two species straying to our

coast. Many of them inhabit considerable depths in the ocean. The young often differ widely in appearance from the adult.

(*Berycidæ* Günther, i, 8–50; exclusive of certain genera.)

a. Dorsal fin continuous, the spinous part short; anal spines 3; abdomen serrated.
HOPLOSTETHUS, 238.

aa. Dorsal fin deeply emarginate, the spinous part long; anal spines 4.
HOLOCENTRUS, 239.

238.—HOPLOSTETHUS Cuv. & Val.

(Cuvier & Valenciennes, Hist. Nat. Poiss. iv, 469, 1829: type *Hoplostethus mediterraneus* Cuv. & Val.)

Body short and deep, much compressed. Head short, compressed, very blunt anteriorly, deeper than long, with very conspicuous mucous cavities. Eye very large. Mouth very oblique, the jaws equal when the mouth is closed. Maxillary long, broad behind, with a distinct supplemental bone, which reaches the posterior border of the eye. Teeth very fine, villiform, on jaws and palatines, none on the vomer. Suborbital with radiating ridges and a few spines; a vertical ridge on the front of the opercle. Opercle little developed, its spine small or obsolete; a strong spine at the angle of the preopercle; the long vertical limb of the preopercle finely serrated. Gill-membranes separate, free from the isthmus. Branchiostegals 8. Scales moderate or small, ctenoid; lateral line present, its scales enlarged; abdomen with a series of bony plates each, ending in a retrose spine. Dorsal fin continuous, short, the spines graduated, 6 in number; anal with 3 graduated spines; caudal forked, its rudimentary rays spinous; pectorals low, rather long; ventrals I, 6, rather short. Air-bladder simple. Pyloric cœca numerous. Vertebræ 11+15. Deep-sea fishes. (ὅπλος, armed; στεθος, breast.)

719. H. mediterraneus C. & V.

Silvery, rosy in life; fins scarlet, peritoneum and inside of mouth black. Eye very large, much longer than snout, forming about one-third the length of head. Abdominal plates 9–13 in number. Body above with very small roughish scales; sides nearly or quite naked (in the young example seen), scaly in the adult. Pectorals reaching first soft ray of anal; ventrals to vent; fins rather low. Head $2\frac{1}{2}$; depth $1\frac{3}{4}$. D. VI, 16; A. III, 8; Lat. l. 28. Length of specimen 3 inches, lately dredged by the U. S. Fish Commission off Chesapeake Bay. Coasts of Southern Europe.

(C. & V. iv, 469; Günther, i, 9: *Trachichthys speciosus* Lowe, Fish. Madeira, 651.)

239.—HOLOCENTRUS Bloch.

Squirrel-fishes.

(*Rhynchichthys* Cuv. & Val.; young.)

(Artedi; Bloch, Ausl. Fische, iv, 61, about 1787: type *Holocentrus sogo* Bloch.)

Body oblong, moderately compressed, the ventral outline nearly straight, the back a little elevated, the tail very slender. Head compressed, narrowed forward. Operculum with a strong spine above, below which the edge is sharply serrated; a strong spine at the angle of preopercle. Orbital ring, preorbital, preopercle, interopercle, subopercle, occiput, and shoulder girdle with their edges sharply serrate. Mouth small, terminal, the lower jaw projecting in the adult; in the young (which constitute the supposed genus *Rhynchichthys*), the snout is much produced. Maxillary broad, striate, with a supplemental bone. Eye excessively large. Scales large, closely imbricated, the posterior margin strongly spinous. Lateral line continuous. Dorsal deeply emarginate, the spines usually 11, depressible in a groove; soft dorsal short and high; anal with 4 spines, the first and second quite small, the third very long and strong, the fourth smaller; caudal widely forked; both lobes with the rudimentary rays spine-like; ventrals large, I, 7, the spine very strong. Species numerous, remarkable for the development of sharp spines almost everywhere on the surface of the body. (ὅλος, wholly; κέντρον, spine.)

720. H. pentacanthus (Bloch) Vaill. & Boc.—*Squirrel-fish.*

Chiefly bright red, with shining longitudinal streaks; fins not black. Mouth small, the maxillary scarcely reaching middle of orbit. Soft dorsal as high as the body; ventrals much longer than pectorals, reaching vent. Head $3\frac{1}{2}$ in length; depth $3\frac{1}{3}$. Eye about $2\frac{1}{3}$ in head. D. XI, 15; A. IV, 10; V. I, 7; Lat. l. 50. Vertebræ 11 + 16. Cœca 25. West Indies; accidental on our coast; once taken at Newport, R. I. "Its bright color and nervous darting motions rendering it one of the most conspicuous denizens of the rock-pools. The local name refers to the grunting noise uttered by them, which resembles the bark of a squirrel." (*Goode.*)

(*Bodianus pentacanthus** Bloch, Ausl. Fische, iv, 40, taf. 225: *Holocentrus sogo* Bloch, Ausl. Fische, iv, 61, taf. 232: *Perca rufa* Walbaum, Artedi, Pisc. 1792, 351; *Holocentrum longipinne* Günther, i, 28; Vaillant & Bocourt, Miss. Sci. au Mex. 144.)

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* "Opercula squamosa. Anteriora 5 spinis pone horrida." (*Bloch.*)

Family LXXXIII (*a*).—APHREDODERIDÆ.

(*The Pirate Perches.*)

Body oblong, elevated at the base of the dorsal, compressed behind, the head thick and depressed, the profile concave. Caudal peduncle thick. Mouth moderate, somewhat oblique, the lower jaw projecting; maxillary reaching to anterior border of the eye. Teeth in villiform bands on jaws, vomer, palatines, and pterygoids. Premaxillaries not protractile; maxillaries small, without evident supplemental bone. Preopercle and preorbital with their free edges sharply serrate; opercle with a spine. Bones of skull somewhat cavernous. Sides of the head scaly. Lower pharyngeals narrow, separate, with villiform teeth. Gill-membranes slightly joined to the isthmus anteriorly. Gill-rakers tubercle-like, dentate. Pseudobranchiæ obsolete. Gills 4, a small slit behind the fourth. Branchiostegals 6. Scales moderate, strongly ctenoid, adherent. Lateral line imperfect or wanting. Vent always anterior, its position varying with age,* from just behind the ventral fins in the young, to below the preopercle in the adult. Dorsal fin single, median, high, with but 3 or 4 spines, which are rapidly graduated, the first being very short. Anal small, with 2 slender spines; ventral fins thoracic, without distinct spine, the number of rays usually 7; caudal fin rounded behind. Air-bladder simple, large, adherent to the walls of the abdomen. Vertebræ 14 + 15. Pyloric cœca about 12. A single genus, with probably but one species. Confined to the United States.

(*Aphredoderidæ* Günther, i, 271.)

240.—APHREDODERUS Le Sueur.

Pirate Perches.

(Le Sueur; Cuv. & Val. Hist. Nat. Poiss. ix, 445, 1833: type *Aphredoderus gibbosus* Le Sueur = *Scolopsis sayanus* Gilliams.)

Characters of the genus included above. (*ἄφοδος*, excrement; *δέρη*, the throat, from the position of the vent; hence more correctly *Aphododerus*.)

721. A. sayanus (Gilliams) DeKay.—*Pirate Perch.*

Color dark olive, profusely speckled with dark points which often make blackish streaks along rows of scales; two blackish bars at base of caudal, between which is a light bar. Head 3; depth 3. D. III, 11

* This singular fact was first noticed by Professor S. A. Forbes.

(IV, 10); A. II, 6; V. 7; B. 6; Lat. l. 47–58. L. 5 inches. Sluggish streams and bayous from New York coastwise to Louisiana, and throughout the Mississippi Basin in lowlands and streams with alluvial bottoms; locally abundant, variable. The singular variations in the position of the vent have given rise to several nominal species and a nominal genus.

(*Scolopsis sayanus* Gilliams, Journ. Acad. Nat. Sci. Phila. iv, 81: *Aphredoderus gibbosus* C. & V. ix, 448: *Sternotremia isolepis* Nelson, Bull. Ills. Nat. Mus. i, 39, 1876: *Aphrodedirus cookianus* Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 60: *Asternotremia mesotrema* Jordan, Bull. U. S. Nat. Mus. x, 52: *Aphododerus isolepis* Jordan, Man. Vert. ed. 2, 249; Günther, i, 271. For description of variations in the position of the vent, see Jordan, Bull. Ill. Lab. Nat. Hist. ii, 48, 1878.)

Family LXXXIII (*b*).—ELASSOMATIDÆ.

(*The Elassomes.*)

Body oblong, compressed, covered with rather large, cycloid scales. Mouth small, terminal, the lower jaw projecting; both jaws with rather strong conic teeth in few series; no teeth on vomer or palatines; upper jaw very protractile. Bones of head with entire edges. Cheeks and opercles scaly. Gill-membranes broadly united, free from the isthmus; gill-rakers tubercle-like. Lower pharyngeals narrow, separate, with sharp teeth. Branchiostegals apparently 5. Lateral line obsolete. Vent normal. Dorsal fin single, small, with about 4 spines; anal with 3 spines; ventrals thoracic I, 5; caudal rounded. Pseudobranchiæ none. Vertebræ 24. One species known, a very singular little fish, one of the smallest known, inhabiting the fresh waters of the United States; intermediate between the *Aphredoderidæ* and *Centrarchidæ*.

241.—ELASSOMA Jordan.

(Jordan, Bull. U. S. Nat. Mus. x, 50, 1877: type *Elassoma zonata* Jordan.)

Characters of the genus included above. (ἐλασσόωμα, a diminution.)

722. E. zonatum Jordan.

Color olive green, everywhere finely punctulate; sides with about eleven parallel vertical bands of dark olive, about equal in width, narrower than the eye; the bands about as wide as the pale interspaces; a conspicuous roundish black spot, nearly as large as the eye, on the sides just above the axis of the body, under the beginning of the dorsal; soft fins faintly barred; a blackish bar at base of caudal. Body oblong, compressed, the nape rather broad and depressed. Head narrowed forward. Eye large, 3 in head. Mouth small, oblique, the

maxillary scarcely reaching pupil. Teeth in jaws stout, conical, slightly curved, in two or three rows. Head 3; depth $3\frac{1}{2}$. D. IV, 10; A. III, 5; B. 5; scales 42 + 19. L. $1\frac{1}{2}$ inches. Smallest of our spinous-rayed fishes, inhabiting sluggish streams and bayous, from South Illinois to Texas and Alabama.

(Jordan, Bull. x, U. S. Nat. Mus. 50, 1877; Jordan, Man. Vert. ed. 2, 248; Jordan, Bull. Ills. Lab. Nat. Hist. ii, 47; Hay. Proc. U. S. Nat. Mus. iii, 1880, 500.)

Family LXXXIV.—CENTRARCHIDÆ.*

(*The Sun-fishes.*)

Percoid fishes with the body more or less shortened and compressed; the regions above and below the axis of the body nearly equally developed, and corresponding to each other, and the pseudobranchiæ imperfect. Head compressed. Mouth terminal, large or small. Teeth in villiform bands, the outer slightly enlarged, without canines; teeth present on premaxillaries, lower jaw, and vomer, and usually on palatines also, sometimes on tongue, pterygoids, and hyoid. Premaxillaries protractile; maxillary with a supplemental bone, which, in one genus, is sometimes minute or obsolete. Preopercle entire or somewhat serrate; opercle ending in two flat points or prolonged in a black flap at the angle. Preorbital short and deep; first suborbital narrow, the maxillary not slipping under its edge. Gills 4, a slit behind the fourth. Pseudobranchiæ small, almost glandular, nearly or quite covered by skin. Gill-membranes separate, free from the isthmus. Branchiostegals 6 or rarely 7. Gill-rakers variously formed, armed with small teeth; lower pharyngeal bones separate, their teeth conic or sometimes paved. Cheeks and opercles scaly. Body fully scaled, the scales usually not strongly ctenoid, rarely cycloid. Lateral line present, usually complete. Dorsal fins confluent, the spines 6–13 in number (usually 10), depressible in a shallow groove; anal spines 3–9. Intestinal canal short. Pyloric cœca 5–10. Vertebræ about 30. Coloration usually brilliant, chiefly greenish. Sexes similar; changes with age often great. Fresh-water fishes of North America; genera 10; species about 25, forming one of the most characteristic features of our fish fauna. Many of the species build nests, which they defend with much courage. All are carnivorous, voracious, and gamy. All are valued as food in direct proportion to the size which they attain.

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* We are indebted to Mr. Chas. L. McKay for the results of his studies of this family, in the advance of the publication of a monograph of the group.

This is a very natural and peculiar group, but its claim to recognition as a distinct family is questionable, as the only character of importance which separates it from *Serranidæ* is the rudimentary character of the pseudobranchiæ. There is a strong analogical resemblance between the *Centrarchidæ* and the *Cichlidæ*.

(*Percidæ*, group *Grystina*, pt. Günther, i, 256–261.)

a. Dorsal fin scarcely larger than anal; gill-rakers very long and slender.
b. Spinous dorsal longer than soft part, the spines about 12; anal spines usually 8.
CENTRARCHUS, 242.
bb. Spinous dorsal shorter than soft part, the spines 5–8, anal spines 6.
POMOXYS, 243.
aa. Dorsal fin much larger than anal; gill-rakers shorter.
c. Body comparatively short and deep; dorsal fin not deeply divided.
d. Tongue and pterygoids with teeth; mouth large.
e. Scales ctenoid; caudal emarginate.
f. Operculum emarginate behind; anal spines 5–7.
g. Branchiostegals 7 ..... ARCHOPLITES, 244.
gg. Branchiostegals 6 ..... AMBLOPLITES, 245.
ff. Operculum ending in a black convex process or flap; anal spines 3.
CHÆNOBRYTTUS, 246.
ee. Scales cycloid; caudal fin convex ..... ACANTHARCHUS, 247.
d. Tongue and pterygoids toothless; mouth small.
h. Caudal fin convex; operculum emarginate behind.
i. Dorsal fin continuous; dorsal spines normally 9; anal spines 3.
ENNEACANTHUS, 248.
ii. Dorsal fin angulated, some of the middle spines higher than the posterior ones; dor-al spines 10; anal 3..... MESOGONISTIUS, 249.
hh. Caudal fin emarginate; operculum prolonged behind in a convex process or flap, which is always black..... LEPOMIS, 250.
cc. Body elongate; dorsal fin low, deeply emarginate; mouth large; caudal emarginate..... MICROPTERUS, 251.

242.—CENTRARCHUS Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poiss. iii, 62, 1829: type *Labrus irideus* Lacépède.)

Body short and deep, compressed. Mouth moderate, the lower jaw the longer; maxillary with a well-developed supplemental bone. Teeth on vomer and palatines. Opercle emarginate behind. Gill-rakers setiform, very long, finely dentate, in large number (20–30 of the large ones). Fins large; the dorsal and anal fins about equal in extent, the soft portion of the latter longest and most posterior, the two fins being obliquely opposed; dorsal fin with the spinous part longer than the soft part, of about 12 spines, which are not rapidly graduated; anal fin with about 8 spines. Scales large, not strongly ctenoid. (κεντρον, spine; αρχος, anus, from the development of the anal spines.)

723. C. macropterus (Lac.) Jor.

Body ovate, strongly compressed. Head small. Mouth moderate, very oblique, the maxillary reaching pupil. Preopercle and preorbital

finely serrate; 5 or 6 rows of scales on cheek. Fins high; ventral spine reaching beyond the vent. Mandible about half the length of the head. Color green, with series of dark-brown spots on sides, below lateral line, forming interrupted longitudinal lines; belly yellowish; a dusky opercular spot; fins with reddish or brownish markings; the dark colors on vertical fins forming reticulations around paler spots; conspicuous ocellated black spot usually present on last rays of dorsal fin, especially distinct in the young, disappearing with age. Head $3\frac{1}{4}$; depth 2. D. XI or XII, 12; A. VII or VIII, 15; scales 5–44–14. L. 6 inches. North Carolina to South Illinois and southward; abundant in lowland streams.

(*Labrus macropterus* Lacépède, Hist. Nat. Poiss. iii, 447, 1802; Jordan, Bull. U. S. Nat. Mus. x, 30: *Labrus irideus* Lacépède, Hist. Nat. Poiss. iv, 716, 1802: *Centrarchus irideus* Holbr. Ichth. S. C. 1860, 18: *Centrarchus irideus* Günther, i, 257: *Centrarchus irideus* Jordan, Bull. U. S. Nat. Mus. x, 30.)

243.—POMOXYS Rafinesque.

Crappies.

(*Pomoxis* Rafinesque, Journ. Acad. Nat. Sci. Phila. i, 417, 1818: type *Pomoxis annularis* Raf.)

Body more or less elongate, strongly compressed, the snout projecting. Mouth large, oblique; maxillary broad, with a well-developed supplemental bone. Teeth on vomer and palatines; few or none on tongue. Lower pharyngeals narrow, with sharp teeth. Gill-rakers long and slender, numerous. Opercle emarginate; preopercle slightly dentate. Scales large, moderately ctenoid. Fins large, the anal larger than the dorsal, of 6 spines and about 17 rays; dorsal with 6–8 graduated spines, the spinous dorsal shorter than the soft part; caudal fin emarginate. Branchiostegals 7. ($\pi\tilde{\omega}\mu\alpha$, opercle; $o\xi\upsilon\varsigma$, sharp; the opercle ending in two flat points instead of an "ear-flap.")

a. Dorsal spines 6. (*Pomoxys.*)

724. P. annularis Raf.—*Crappie; Bachelor; New Light; Campbellite.*

Body elongate. Head long, the profile more or less strongly S-shaped, owing to the projecting snout, depressed occipital region, and very prominent thickened ante-dorsal area. Mouth very wide, the maxillary reaching past the pupil. Scales on cheeks in 4–5 rows. Eye large, 4 in head. Color silvery olive, mottled with dark green, the dark marks chiefly on the upper part of the body and having a tendency to form narrow vertical bars; dorsal and caudal fins marked with green; anal fin pale, nearly plain. Fins very high, but lower than in *P. sparoides.* Head 3; depth $2\frac{1}{3}$. D. VI, 15; A. VI, 18; Lat. l. 36–48. L. 12 inches.

Variable. Mississippi Valley, &c.; abundant southward, chiefly in sluggish streams; valued as a food-fish.

(Rafinesque, Amer. Monthly Mag. 1818, 41; Raf. Journ. Acad. Nat. Sci. Phila. 1818, 417; Raf. Ichth. Oh. 1820, 33; Jordan & Copeland, Proc. Acad. Nat. Sci. Phila. 1876: *Pomoxys storerius, brevicauda, intermedius,* and *protacanthus* Gill, Proc. Acad. Nat. Sci. Phila. 1865, 64–66: *Centrarchus nitidus* Günther, i, 257.)

aa. Dorsal spines 7 or 8. (*Hyperistius** Gill.)

725. P. sparoides (Lac.) Grd.—*Calico Bass; Grass Bass; Barfish; Strawberry Bass.*

Body oblong, elevated, much compressed. Head long, its profile not strongly S-shaped; the projection of the snout and ante-dorsal region and the depression over the eye being less marked than in *P. annularis.* Mouth smaller than in *P. annularis,* the maxillary reaching about to the posterior edge of pupil, the mandible shorter than pectorals. Scales on cheeks in 6 rows. Fins very high; anal higher than dorsal, its height 4–5 times in length of body. Color silvery olive, mottled with clear olive-green, the dark mottlings gathered in irregular small bunches, and covering the whole body; vertical fins with dark olive reticulations surrounding pale spots; the anal marked like the dorsal; a dusky opercular spot. Head 3; depth 2. D. VII or VIII, 15; A. VI, 17 or 18; Lat. l. 41. L. 12 inches. Great Lakes and Upper Mississippi Valley to New Jersey, and southward to Florida and Louisiana; chiefly in lowland streams and lakes; a handsome fish, valued as food.

(*Labrus sparoides* Lacép. Hist. Nat. Poiss. iii, 1802, 517; and iv, 717: *Centrarchus sparoides* C. & V. iii, 8, 1829: *Centrarchus hexacanthus* C. & V. vii, 458, 1831: *Centrarchus hexacanthus* Günther, i, 257: *Pomoxys hexacanthus* Holbrook, Ichth. S. C. 29: *Pomoxys nigromaculatus* Jordan, Man. Vert. ed. 2, 247, and Bull. U. S. Nat. Mus. x, 37, based on *Cantharus nigromaculatus* Le Sueur MSS., noticed by C. & V. iii, 8.)

244.—ARCHOPLITES Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1861, 165: type *Centrarchus interruptus* Girard.)

Body oblong, compressed, the back elevated. Mouth large, oblique, the broad maxillary with a well developed supernumerary bone. Teeth on jaws, vomer, palatines, tongue, and pterygoids; lingual teeth in two patches; pharyngeal teeth pointed. Gill-rakers long and strong, compressed, numerous, about 20 in number, some of them on the upper portion of the arch. Branchiostegals 7. Operculum emarginate, the lower point much the larger, striate, the ridges terminating in small spines; preopercle, interopercle, subopercle, suborbital and preorbital with their inferior edges conspicuously serrate; dentaries and preopercle with large muciferous depressions or pits. Dorsal fin with about 13 spines; anal

* Gill, Amer. Journ. Sci. Arts, 1864, 92: type *Centrarchus hexacanthus* C. & V. (ὑπηρ, high; ἱστιον, sail.)

usually with 7 spines. Caudal emarginate. Scales strongly ctenoid. California. (*αρχος*, anus; *ὅπλιτης*, armed.)

726. A. interruptus (Grd.) Gill.—*Sacramento Perch.*

Body oblong-ovate, compressed, the back considerably elevated anteriorly, depressed over the eye, the snout projecting at an angle. Mouth terminal, very large, the maxillary very broad, extending beyond pupil. Eye very large, 4 to 5 in head. Scales on cheek in about eight series. Dorsal spines rather low, strong; anal spines similar. Pectoral short, barely reaching anal. Color blackish above, sides silvery, with about seven vertical blackish bars, irregular in form and position and more or less interrupted; a black opercular spot; fins nearly plain. Head $2\frac{2}{3}$; depth $2\frac{1}{2}$. D. XIII, 10; A. VII, 10; scales about 7–51–14. L. 12 inches. Sacramento and San Joaquin rivers; abundant; the only fresh-water percoid west of the Rocky Mountains.

(*Centrarchus interruptus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 129: *Ambloplites interruptus* Girard, U. S. Pac. R. R. Surv. Fish. 10: *Centrarchus interruptus* Günther, i, 257: *Centrarchus maculosus* Ayres, Proc. Cal. Acad. Nat. Sci. i, 1854, 8.)

245.—AMBLOPLITES Rafinesque.

Rock Bass.

(Rafinesque, Ichth. Oh. 1820, 33: type *Lepomis ictheloides* Raf.=*Bodianus rupestris* Raf.)

Body oblong, moderately elevated, compressed. Mouth large, the broad maxillary with a well-developed supplemental bone; lower jaw projecting. Teeth on vomer, palatines, tongue, and pterygoids; lingual teeth in a single patch; pharyngeal teeth sharp. Branchiostegals 6. Opercle ending in 2 flat points; preopercle serrate at its angle; other membrane bones chiefly entire. Gill-rakers rather long and strong, dentate, less than 10 in number, developed only on the lower portion of the arch. Scales large, somewhat ctenoid. Dorsal fin much more developed than the anal fin, with 10 to 11 rather low spines; anal spines normally 6. Caudal fin emarginate. (*αμβλυς*, blunt; *ὅπλιτης*, armed.)

727. A. rupestris (Raf.) Gill.—*Common Rock Bass; Red-Eye; Goggle-Eye.*

Body oblong, moderately compressed. Head large, the profile little depressed above the eye. Mouth large, the maxillary extending to opposite posterior part of pupil. Eye very large, $3\frac{1}{2}$ in head. Gill rakers few, about 10 developed. Scales on cheeks in 6 to 8 series; preopercle serrate near its angle. Color olive green, brassy-tinged, with much dark mottling; the young irregularly barred and blotched with black, the adult with a dark spot on each scale, these forming inter-

rupted black stripes; a black opercular spot; dark mottlings on the soft dorsal, anal, and caudal. Head $2\frac{3}{4}$; depth 2–$2\frac{1}{2}$, D. XI, 10; A. VI, 10; scales about 5–39–12. Cœca 7. Vert. 14 + 18. L. 12 inches. Vermont to Great Lake region and Manitoba, south to Louisiana; very abundant west of the Alleghanies.

(*Bodianus rupestris* Raf. Am. Monthly Mag. 1817, 120: *Centrarchus æneus* C. & V. iii, 84: *Centrarchus æneus* Günther, i, 256; Jordan, Man. Vert. ed. 2, 237: *Ambloplites cavifrons* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 217, is probably a young specimen of this species.*)

246.—CHÆNOBRYTTUS Gill.

War-mouths.

(*Calliurus* Ag. not of Raf.)

(Gill. Amer. Journ. Sci. Arts, 1864, 92: type *Calliurus melanops* Grd. = *Pomotis gulosus* Cuv. & Val.)

This genus has the general form and dentition of *Ambloplites* with the convex opercle, 10 dorsal and 3 anal spines of *Lepomis*. Preopercle entire. Branchiostegals 6. Caudal fin emarginate. Scales weakly ctenoid. (χαινώ, to yawn; *Bryttus*, i. e. *Lepomis*.)

a. Dorsal beginning above the opercular spot.

728. C. antistius McKay.—*Goggle Eye.*

Body heavy, deep and thick, stouter and less elongate than in the next. Head deep. Mouth large, the maxillary reaching nearly to posterior margin of the eye; the supplemental bone strong. Scales on cheeks in 7 or 8 rows. Opercular flap broad. Eye small, $4\frac{1}{2}$ in head; preopercle and mandible with large mucous pits. Dorsal beginning directly over the opercular spot, which is above base of pectoral; spines of dorsal very stout, the longest as long as from snout to middle of eye. Color in life dark olive-green above; sides greenish and brassy, with blotches of pale blue and bright coppery red, the red predominating; belly bright brassy yellow, profusely mottled with bright red; lower jaw chiefly yellow; iris bright red; opercular spot as large as eye, black, bordered with copper color; 3 or 4 wide dark red bands radiating backwards from eye across cheeks and opercles, separated by narrow pale blue inter-

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* *A. cavifrons* Cope.

Physiognomy more of *Centrarchus*. Mouth large, very oblique, the maxillary reaching beyond the middle of the pupil; chin prominent. Outline of cranium concave. Eye large, 3 in head. Scales of cheeks very few, minute. Mucous cavities large. Silvery, dusted with dark points; scales with a narrow vertical dark shade at base; soft fins dusky; a small black opercular spot. Depth $2\frac{1}{3}$. D. X, 12; A. VI, 11; scales 7–38–13. Roanoke River, Virginia. (*Cope.*)

spaces; upper fins chiefly black, mottled with orange and blue; lower fins dusky; a small black spot on last rays of dorsal; color in spirits very dark, the reddish shades becoming black; young with vertical chains of spots. Head $2\frac{2}{3}$; depth $2\frac{1}{3}$. D. X, 10; A. III, 9; scales 6–40–12. L. 10 inches. Lake Michigan and Upper Mississippi Valley; abundant.

(*Glossoplites melanops* Jor. Man. Vert. ed. 1, 1876, 223, 317: *Chænobryttus gulosus* Jordan, Man. Vert. ed. 2, 1878, 237: *Chænobryttus gulosus* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 359, not *Pomotis gulosus* C. & V.; McKay, Proc. U. S. Nat. Mus. 1881.)

aa. Dorsal fin beginning behind the vertical of the base of the pectorals.

729. C. gulosus (C. & V.) Jor.—*War-mouth; Red-eyed Bream.*

Very similar to the preceding; the body more compressed and more elongate, the profile less steep. Scales of cheeks larger, in about 6–8 rows. Opercular spot smaller. Eye $4\frac{1}{2}$ in head. Dorsal beginning behind base of pectoral; pectoral short, barely reaching anal. Color in life clear olive-green clouded with darker, usually without red or blue; a dusky spot on each scale more or less distinct; vertical fins mottled with dusky; a faint spot on last rays of dorsal bordered by paler; 3 oblique dusky bars radiating from eye; belly yellowish. Head $2\frac{1}{5}$; depth $2\frac{1}{2}$. D. X, 9; A. III, 8; scales 6–43–11. L. 9 inches. Virginia to Texas; abundant only southward. Close to the preceding, but distinguishable by the posterior insertion of the dorsal.

(*Pomotis gulosus* Cuv. & Val. iii, 367, 1829: *Centrarchus gulosus* and *viridis* C. & V. vii, 437, 460, 1831: *Centrarchus gulosus* Günther, i, 258: *Calliurus floridensis* Holbrook, Journ. Acad. Nat. Sci. Phila. 1855, 53: *Bryttus floridensis* Günther, i, 260: *Lepomis gillii* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 225: *Chænobryttus viridis* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 360: *Chænobryttus viridis* Jordan, Man. Vert. ed. 2, 238: *Calliurus melanops* Girard, U. S. Pac. R. R. Surv. x, 11: *Bryttus melanops* Günther, i, 260: *Lepomis charybdis* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 24.)

247.—ACANTHARCHUS Gill.

(Gill, Amer. Journ. Sci. Arts, 1864, 92: type *Centrarchus pomotis* Baird.)

Body oblong, robust, not much compressed or elevated. Mouth not very large, the broad maxillary with a well developed supplemental bone; lower jaw projecting. Teeth on vomer, palatines, pterygoids, and tongue; lingual teeth in a single patch; pharyngeal teeth sharp. Gill-rakers few, rather long and strong. Opercle emarginate; preopercle entire. Scales cycloid, large. Lateral line complete. Dorsal spines usually 11; anal spines 5; caudal fin rounded behind. (*ακανθα*, spine; *αρχον*, anus.)

730. A. pomotis (Baird) Gill.—*Mud Sun-fish.*

Body oblong, moderately compressed. Snout short. Mouth wide, the gape short; the maxillary reaching posterior part of orbit. Eye not very large, 3½ to 4 in head. Cheeks with about 5 rows of scales. Dorsal spines low; the longest about as long as from snout to middle of pupil. Color very dark greenish; body usually with five rather indistinct blackish longitudinal bands along the sides; cheeks with dark bands, which run nearly parallel, the lowest passing across the maxillary around the front part of the lower jaw. Fins plain dusky. A black opercular spot. Head 2⅔; depth 2. D. XI, 10; A. V, 10; scales 6–43–12. L. 4 inches. Southern New York to South Carolina, in sluggish streams near the coast.

(*Centrarchus pomotis* Baird, 9th Smithson. Rep. 1854, 325; Jordan, Man. Vert. ed. 2, 237: *Centrarchus pomotis*, Günther, i, 256.)

248.—ENNEACANTHUS Gill.

Hemioplites Cope: *Copelandia* Jordan.)

(Gill, Am. Journ. Sci. Arts. 1864, 92: type *Pomotis obesus* Grd.)

Body rather short and deep, compressed. Mouth small; the supplemental maxillary bone well developed. Teeth on vomer and palatines, none on the tongue. Opercle ending behind in two flat points, with a dermal border. Preopercle entire. Scales rather large, the lateral line sometimes interrupted. Dorsal fin continuous, normally with 9 spines; anal fin smaller than the dorsal, with 3 spines; caudal fin convex behind. Branchiostegals 6. Species of small size and bright coloration. Abnormal variations in the number of dorsal and anal spines have given rise to the nominal genera *Hemioplites* and *Copelandia*. (εννεα, nine; ακανθα, spine.)

731. E. eriarchus (Jordan) McKay.

Body rather elongate, the profile forming a nearly uniform curve. Eye large, 3 in head. Mouth moderate, maxillary reaching slightly beyond front of pupil; its supplemental bone well developed. Scales on cheek in about 3 rows. Soft dorsal high, its longest rays equal to distance from snout to front of opercle; anal fin very large, with strong spines. Pectorals reaching beyond anal spines; ventral spines reaching anal. Lateral line incomplete. Olivaceous; vertical fins with round (blue?) spots. Head 2¾; depth 2¼. D. X, 9; A. IV, 8; scales 4–33–10. L. 3 inches. Menomonee River, Milwaukee, Wisconsin; but one specimen preserved. It is probably an *Enneacanthus* with an abnormal in-

crease in the number of spines. Specimens of *E. simulans* with the same numbers are occasionally found.

(*Copelandia eriarcha* Jordan, Proc. Ac. Nat. Sci. Phila. 1877, 56; McKay, Proc. U. S. Nat. Mus. 1881.)

732. E. obesus (Baird) Gill.

Body oblong-ovate, elliptical. Scales large, little crowded. Dorsal spines $2\frac{1}{2}$ in head, as long as from snout to posterior margin of eye. Anal fin large; ventral spine not reaching vent, its first ray not reaching the base of the last anal spine; caudal fin moderate, about as long as from snout to middle of opercle; opercular spot rather large, more than half the size of the eye, velvet black, bordered with purple. Eye $3\frac{1}{4}$ in head; cheeks with four rows of scales. Color olivaceous, with 5–8 well-defined dark cross-bars; spots on body and fins purplish or golden; cheek with lines and spots; a dark bar below eye. Head $2\frac{2}{3}$; depth $1\frac{4}{5}$. D. IX, 10; A. III, 10; scales 4–32–10; the pores developed usually on about 20 scales, but sometimes on nearly all of them. L. 3 inches. Massachusetts to Florida, abundant in sluggish streams near the coast.

(*Pomotis obesus* Baird, 9th Smiths. Rept. 1854, 324: *Bryttus obesus* Girard, Proc. Acad. Nat. Sc. Phila. 1859, 53; Jordan, Man. Vert. 245: *Bryttus fasciatus* Holbrook, Journ. Acad. Nat. Sci. Phila. 1855, 51: *Bryttus fasciatus* Günther, i, 260; Cope, Proc. Acad. Nat. Sci. Phila. 1878, 65: *Pomotis guttatus* Morris, Proc. Acad. Nat. Sci. Phila. 1859.)

733. E. gloriosus (Holbr.) Jor.

Body oval, moderately compressed, the profile concave above eye. Opercular spot scarcely larger than pupil. Caudal about as long as from snout to anterior margin of preopercle. Color olive-green, yellowish below, speckled above with golden; no vertical bands; fins rosy, with golden spots, often a dusky spot at base of caudal. Head $2\frac{1}{4}$; depth $1\frac{1}{2}$. D. IX, 11; A. III, 10. L. $2\frac{3}{4}$ inches. Maryland to Florida, in clear sluggish streams.

(*Bryttus gloriosus* Holbr. Journ. Acad. Nat. Sci. Phila. 1855, 51: *Bryttus gloriosus* Günther, i, 260; Uhler & Lugger, Fishes Maryland, 112.)

734. E. simulans (Cope) McKay.

Body comparatively elongate. Mouth moderate, very oblique, the maxillary reaching just past the front of orbit. Dorsal spines medium; soft rays in the males somewhat elevated, reaching to or beyond (var. *pinniger*) the base of the caudal; the longest soft ray as long as from snout to front of opercle, or (var. *pinniger*) as long as head; fins in females all lower; pectoral fin reaching nearly to middle of anal. Eye $3\frac{1}{4}$ in head. Lateral line usually, but not always, complete. Color dark olive; young with traces of vertical darker bars; ear-flap small, with a

blue border, and a pearly spot in front; a dark bar about width of pupil extending obliquely downwards below eye; sides of head, whole body and vertical fins, in the males, with round bright blue spots arranged in irregular rows, these spots most distinct on the cheeks and opercles and on the lower part of the sides; females duller, with larger and fainter spots more regular in position. A dark bar below eye. Head $2\frac{3}{4}$; depth $2\frac{1}{4}$. D. IX, 10; A. III, 9 (occasionally D. X, or A. IV, in abnormal specimens); scales 3–30–9. New Jersey to North Carolina; abundant near the coast.

(*Hemioplites simulans* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 218; based on specimen with 4 anal spines: *Enneacanthus margarotis* Gill & Jordan, Bull. U. S. Nat. Mus. x, 28, 1878: *Enneacanthus guttatus* Cope, Journ. Acad. Nat. Sci. Phila. 1869, 219: *Enneacanthus pinniger* Jordan, Bull. U. S. Nat. Mus. x, 27, 1878, a southern form, distinguished by the larger size, brighter color, and larger fins, all doubtless the result of more favorable surroundings.)

249.—MESOGONISTIUS Gill.

Banded Sun-fishes.

(Gill, Amer. Journ. Sci. Arts, 1864, 92: type *Pomotis chætodon* Baird.)

Body short and deep, compressed. Mouth small. Teeth present on vomer and palatines, none on the tongue; supplemental maxillary bone small. Gill-rakers rather strong, dentate. Opercle ending in two flat points, with a dermal border; preopercle entire. Scales large. Dorsal with ten spines; outline of the fin angulated, the middle spines being much longer than some of the posterior ones; anal fin much smaller than the dorsal, with 3 spines; caudal fin posteriorly rounded. Size small. (*μεσος*, middle; *ηωνια*, angle; *δστιον*, sail.)

735. M. chætodon (Baird) Gill.—*Black-banded Sun-fish.*

Body suborbicular, compressed. Head moderate, the profile nearly concurrent with the dorsal curve. Mouth very small, the maxillary reaching nearly to the eye. Eye large, 3 in head. Cheeks with 3–4 rows of scales. Fins rather large; dorsal fin high in front, the middle portion depressed. Lateral line continuous. Coloration clouded straw-color, the sides with 6–8 conspicuous but rather irregular black vertical bars, the first through the eye, the second in front of pectorals, interrupted on the operculum, the third at the front of the dorsal covering the membrane of the first three spines, and forming a medial black stripe on each ventral fin, the fourth at front of soft dorsal, the fifth opposite its last ray, the last at the base of the caudal; black opercular spot, with a crescent-shaped paler centre. Fins mottled. Head 3;

depth $1\frac{2}{3}$. D. X, 10; A. III, 12; scales 4–28–10. L. 3 inches. New Jersey to Maryland, in sluggish streams. A handsome little fish.

(*Pomotis chætodon* Baird, Ninth Smithsonian Report, 1854, 324: *Pomotis chætodon* Günther, i, 263; Jordan, Man. Vert. ed. 2, 245.)

250.—LEPOMIS Rafinisque.

Sun-fishes.

(*Ichthelis*, *Pomotis* and *Apomotis* Rafinisque: *Bryttus* Cuv. & Val.: *Xenotis*, *Xystroplites* and *Helioperca* Jordan: *Eupomotis* Gill & Jordan.

(Rafinesque, Journal de Physique, 1819, 402: type *Labrus auritus* L.)

Body oblong or ovate, more or less compressed, the back in the adult somewhat elevated. Mouth moderate or small, the jaws about equal; maxillary narrow, the supplemental bone small or reduced to a mere rudiment or altogether wanting. Teeth on vomer, and usually on palatines; none on tongue or pterygoids; lower pharyngeals narrow, the teeth conic or paved. Gill-rakers mostly short; preoperculum entire; operculum ending behind in a convex flap, black in color, which in some species becomes greatly developed with age. Branchiostegals 6. Scales moderate. Dorsal fin continuous, with ten spines; anal with three spines; caudal fin emarginate. Coloration brilliant, but evanescent. A large genus, one of the most difficult in our fish fauna in which to distinguish species. The form of body, development of ear-flap, and height of spines vary greatly with age. The number of fin-rays and scales are essentially the same in all. (λεπις, scale; πῶμα, operculum, a character supposed to distingush the genus from *Sparus*.)

The species may be subdivided as follows:

* Lower pharyngeals narrow, the teeth mostly conic.
  a. Pharyngeal teeth all, or nearly all, slender, acute.
    b. Supplemental maxillary bone well developed; palatine teeth present; gill-rakers stiff and rather long. (*Apomotis* Raf.) *cyanellus, symmetricus, phenax.*
    bb. Supplemental maxillary reduced to a slight rudiment.
      c. Gill-rakers stiff, not very short; palatine teeth usually present. (*Lepomis.*)
        d. Gill-rakers comparatively long and slender; ear-flap short.
ischyrus, macrochirus, mystacalis, elongatus, murinus, punctatus, miniatus.
        dd. Gill-rakers short, thickish; ear-flap very long and narrow in the adult.
auritus.
      cc. Gill-rakers weak and flexible, very short; no palatine teeth. (*Xenotis* Jordan.)
megalotis, marginatus, bombifrons.
    bbb. Supplemental maxillary obsolete; gill-rakers slender. (*Helioperca.*)
      e. Palatine teeth present ..... *humilis.*
      ee. Palatine teeth none; a black dorsal patch ..... *pallidus.*
  aa. Pharyngeal teeth mostly bluntly conic. (*Xystroplites* Jordan.)
heros, euryorus, albulus.
** Lower pharyngeals broad, with the teeth paved, nearly spherical, truncate above.
Eupomotis Gill & Jordan) ..... *notatus, holbrooki, gibbosus, lirus.*

a. Pharyngeal teeth all or nearly all slender, acute; lower pharyngeals narrow, the teeth mostly conic.

b. Supplemental maxillary evident; palatine teeth present; gill-rakers stiff and rather long. (*Apomotis* * Rafinesque.)

736. L. cyanellus Raf.—*Red-eye; Blue-spotted Sun-fish.*

Body oblong, rather elongate, becoming short and deep with age; moderately compressed. Head large, with projecting snout. Mouth rather large, the maxillary broad and flat, with a small supplemental bone, reaching nearly to the middle of the eye; lower jaw projecting. Dorsal spines quite low, the highest scarcely longer than snout (in the adult, longer in young). Scales small. Opercular spot small, less than eye, broadly margined, the black confined to the bony part. Pectoral short, not reaching anal. Color variable, the prevailing shade green, with a strong brassy lustre on sides, which becomes nearly yellow below; each scale usually with a sky-blue spot and more or less of gilt edging, giving an appearance of pale lateral streaks; besides these marks, dusky or obscure vertical bars are often present, and the sides are sprinkled with dark dots; vertical fins marked with blue or green, the anal usually edged in front with pale orange; usually a conspicuous black spot on posterior base of dorsal and anal, these often obsolete; iris red; cheeks with narrow blue stripes. Scales on cheeks in 8 rows. Head 3; depth $2\frac{1}{2}$. D. X, 11; A. III, 9; Lat. l. about 48 L. 7 inches. Very variable. Great Lake region to Mexico; very abundant southwestward; ascending small brooks.

(Raf. Journ. de Physique, 1819, 420: *Icthelis melanops* Raf. Ichth. Oh. 1820, 28: *Calliurus longulus*, *diaphanus*, *formosus*, and *microps* Girard, U. S. Pac. R. R. Surv. Fish. and U. S. Mex. Bound. Surv. Ichth. 1859: *Bryttus signifer* Grd. U. S. Pac. R. R. Surv. Fish. 20: *Bryttus longulus* Günther, i, 260: *Lepomis microps*, *mineopas*, and *melanops* Cope, Journ. Acad. Nat. Sci. Phila. 1868 223, 224: *Apomotis cyanellus* Jordan, Man. Vert. E. U. S. ed. 2, 239.)

737. L. symmetricus Forbes, sp. nov.

Color dark, most scales with a vertical dark bar at base; cheeks mottled, not striped; sides with about 10 vertical bars, widest forward; pectoral fins pale; ventrals dusky in the male; dorsal fin in the female with a dark ocellated spot on its last ray. Body short, deep, with regular outlines. Mouth moderate, the lower jaw longest, the maxillary reaching the front of the pupil; supplemental maxillary present. Palatine teeth present; pharyngeal teeth rather blunt. Gill-rakers stiff and long. Cheeks with 7 rows of scales. Opercular angle not prolonged,

* Rafinesque, Journ. de Physique, etc., 1819, 420: type *Lepomis cyanellus* Raf.; α, primitive; πῶμα, operculum; ους, ear = *Telipomis* Raf. 1820.

its black spot higher than long, shorter than eye with a narrow pale border. Spinous dorsal rather low, two-thirds height of soft, the longest spine as long as from snout to middle of eye; caudal peduncle short and deep; caudal slightly emarginate; pectorals and ventrals reaching vent. Head $2\frac{2}{3}$; depth $1\frac{3}{4}$. Eye a little longer than snout, $3\frac{2}{3}$ in head. D. X, 10; A. III, 9; scales 6–34–14. L. $2\frac{1}{2}$ inches (adult). Types 15 specimens, in Illinois Laboratory of Natural History from Illinois River. (*Forbes* MSS.)

738. L. phenax (Cope & Jordan) McKay.

Appearance of *Lepomis pallidus*. Body rather short and deep; snout short, projecting, forming an angle over the eye. Mouth moderate, the lower jaw slightly the longer, the maxillary reaching middle of eye, the supplemental bone strong. Eye moderate, $4\frac{1}{2}$ in head. Opercular spot larger than eye. Scales on cheek in 7 rows. Gill-rakers very long. Dorsal spines short and strong, as long as from snout to middle of eye; pectorals long; soft dorsal high, anal higher. Color in spirits nearly plain olive-green; no black spot on dorsal or anal. Head $2\frac{1}{2}$; depth $2\frac{1}{5}$. D. X, 10; A. III, 9; scales 6–43–14. L. 6 inches. Beaseley's Point, New Jersey.

(*Apomotis phenax* Cope & Jordan, Bull. U. S. Nat. Mus. x, 26, 1877; McKay, Proc. U. S. Nat. Mus. 1881.)

bb. Supplemental maxillary reduced to a slight rudiment.

c. Gill-rakers stiff, not very short; palatine teeth usually present. (*Lepomis.*)

d. Gill-rakers comparatively long and slender; ear-flap short.

739. L. ischyrus Jor. & Nelson.

Aspect of *L. pallidus*. Body elongated, robust, much elevated. Mouth wide, the maxillaries reaching middle of orbit. Palatine teeth present. Occiput prominent; top of head flat and short, forming an angle with the descending profile. Scales on cheeks in 6 rows. Fins high, the dorsal spines rather low and very strong, the longest as long as from tip of snout to middle of orbit. Opercular flap large, with a broad pale edge, entirely surrounding the black. Eye large, smaller than opercular spot, $4\frac{1}{2}$ in head. Color dusky, mottled with orange and blue; cheeks with wide obscure blue bands; a dusky spot on dorsal and anal behind; belly and lower fins coppery yellow; lower jaw and lower parts of head leaden blue. Head $2\frac{2}{3}$; depth, $2\frac{1}{6}$. D. X, 12; A. III, 10; scales 5–46–14. L. 7 inches. Illinois River.

(*Ichthelis aquilensis* Nelson, Bull. Ills. Mus. Nat. Hist. i, 37 (not *Pomotis aquilensis* B. & G.); Jordan & Nelson, Bull. U. S. Nat. Mus. x, 25, 1877.)

740. L. macrochirus Raf.

Bright steel-blue, with many bronze orange spots, which cover nearly the whole surface, so arranged that the ground color forms a series of vertical chain-like bars, very conspicuous in life; vertical fins mottled with bronze and usually more or less edged with pale orange; sometimes a faint black dorsal spot; no distinct blue stripes on cheek, but the sides of the head shaded with purplish. Opercular flap small, black, margined with pale. Body rather elongate, the head somewhat acute. Pectoral fins reaching beyond ventrals to anal. Gill-rakers rather long and slender, strongly toothed, 11 developed. Supplemental bone minute. About 7 rows of scales on cheeks. Head 3; depth $2\frac{1}{3}$. D. X, 12; A. III, 10; scales about 6–42–15. L. 5 inches. Ohio Valley; a small, handsome species.

(Raf. Journ. de Physique 1819, 420; Jordan, Man. Vert. ed. 2, 239: *Lepomis nephelus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 222.)

741. L. mystacalis Cope.

Body deep, compressed. Eye large, $3\frac{1}{3}$ in head. Dorsal spines robust, little shorter than the soft rays; paired fins long; maxillary extending somewhat beyond front of orbit; four rows of scales on cheeks; opercular spot short without border. Gill-rakers slender. Dusky, sides silvery, with irregular, short, dark vertical bars; a pale band from mouth across preopercle, a dark line below this, then a silvery band; lower parts and most of vertical fins yellow. Head $3\frac{2}{3}$; depth 2. D. X, 12; A. III, 12; scales 7–51–15. East Florida. (*Cope.*)

(Cope, Proc. Am. Philos. Soc. 1877, 66.)

742. L. elongatus (Holbr.) Gill & Jor.

Body rather elongate, compressed. Front steep. Caudal peduncle long. Maxillary extending to front of eye. Eye large, $3\frac{1}{2}$ in head. Scales on cheek in 6 rows. Opercular flap moderate. Fins high, the longest dorsal fin as long as snout and eye. Dusky above, yellowish below, with faint dark vertical bars on the sides, and a dark blotch on the tail behind the dorsal fin; cheeks with pale bluish lines; fins plain. Head $2\frac{2}{3}$; depth $2\frac{1}{2}$. D. X, 11; A. III, 9. L. 4 inches. South Carolina to Florida. (*Holbrook.*)

(*Pomotis elongatus* Holbr. Journ. Acad. Nat. Sci. Phila. 1855, 47: *Pomotis elongatus* Günther, i, 262: ? *Lepomis ophthalmicus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 224.)

743. L. marginatus (Grd.) McKay.

Body elongate, somewhat compressed, the form precisely as in *L. cyanellus*. Mouth rather large; maxillary about reaching front of eye;

teeth on vomer and front of palatines. Gill-rakers moderate, 9 or 10 developed. Supplemental maxillary scarcely appreciable. Eye equal to interorbital width. Cheeks with 7 rows of scales. Spinous dorsal rather high, the longest spine about as long as from tip of snout to pupil; pectorals short, scarcely reaching vent. Scales small, reduced on breast. Dark greenish; a black spot on dorsal as in *L. cyanellus*. Head $2\frac{3}{5}$; depth 3. D. X, 10; A. III, 9; scales 7–42–15. Texas.

(*Calliurus murinus* Grd. U. S. Pac. R. R. Surv. Fish. 1858, 18, pl. 7, fig. 1; the other specimens examined by Girard belong to *L. cyanellus*: *Bryttus murinus* Günther, i, 260; McKay, Proc. U. S. Nat. Mus. 1881, 88.)

744. L. punctatus (Cuv. &. Val.) Jor.

Body deep, compressed, the profile steep; an angle above the eye. Mouth moderate; maxillary reaching past anterior margin of eye; supplemental maxillary present, small. Palatine teeth present. Gill-rakers rather long, stiff, and strong. Opercular flap small, short, and deep, shorter than eye. Eye large, 4 in head. Scales on the cheeks in 7 rows. Dorsal spines high, the middle ones highest, nearly as long as snout and orbit. Olivaceous, with numerous small deep brown spots, smaller than pin-heads, resembling fly-specks; these are most distinct on the lower part of the sides, where they form lines along the rows of scales, and on the opercles; sometimes they cover the whole body. Fins plain dusky. Head 3; depth $1\frac{7}{8}$. D. X, 11; A. III, 10; scales 6–40–13. L. 5 inches. Streams of Florida; a handsome species, known at sight by the peculiar coloration.

(*Bryttus punctatus* and *reticulatus* Cuv. & Val. vii, 402; Jordan, Proc. U. S. Nat. Mus. ii, 224, 1879: *Lepomis apiatus* Cope, Proc. Am. Phil. Soc. Phila. 1877, 65: *Lepiopomus apiatus* Jordan, Bull. U. S. Nat. Mus. x, 25, 1877.)

745. L. miniatus Jordan.

Body oblong and somewhat regularly elliptical. Mouth rather large. Opercular flap short and broad, entirely black. Scales of cheek in 4 series. Eye large, $3\frac{1}{2}$ in head. Gill-rakers shortish, but stiff and rough. Palatine teeth present. Dorsal spines rather long, as long as from snout to posterior edge of pupil. Pectorals long. Color dark, a scarlet spot on each scale, forming red longitudinal stripes; a dusky mark on each side of each red spot; belly largely orange red; fins dark; no dorsal spot; iris red. Head $2\frac{3}{4}$; depth $2\frac{1}{4}$. D. X, 10; A. III, 9; scales 4–40–11. L. 4 inches. Alabama to Texas; not rare; a small, brightly colored species.

(Jordan, Bull. U. S. Nat. Mus. x, 26, 1877.)

dd. Gill-rakers short, thickish; ear flap in the adult very long and narrow.

746. L. auritus (L.) Raf.—*Long-eared Sun-fish.*

Body elongate, not much elevated. Snout moderately prominent. Mouth rather large, oblique, the maxillary reaching past front of eye. Cheeks with rather small scales, in about 7 rows. Scales of breast very small. Palatine teeth few, rather large. Gill-rakers quite short, not much longer than in *Lepomis megalotis*, but stiff and rough, set wide apart, diminishing in size from the angle forwards. Opercular flap very long (longer in the adult than on any other of the Sun-fishes except *Lepomis megalotis*), narrow, usually not wider than the eye. In the young the flap is variously shorter, but always narrow; lower margin of flap usually pale. Dorsal spines rather low. Color olive; belly largely orange red; scales on the sides with reddish spots on a bluish ground; vertical fins chiefly orange or yellowish; head with bluish stripes, especially in front of eye; fins becoming dusky in spirits; no dusky blotch on last rays of dorsal and anal. Head (without flap) 3 in length; depth $2\frac{1}{3}$. D. X, 11; A. III, 9; Lat. l. 47. L. 8 inches. Maine to Louisiana; abundant in all streams east of the Alleghanies; the typical form, above described, chiefly northward.

(*Labrus auritus* Linn. Syst. Nat. ed. x, 283, 1758: *Labrus auritus* Linn. Syst. Nat. ed. xii, 475, 1766: *Bryttus unicolor* Cuv. & Val. vii, 464: *Pomotis rubricauda* Storer, Bost. Journ. Nat. Hist. iv, 177: *Pomotis appendix* Storer, Hist. Fish. Mass. 1867, 14.)

Var. **solis** (Cuv. & Val.) McKay.

Similar to the preceding, except that the scales on the cheek are larger, in 5 or 6 rows; the scales on the breast are not very small, and there is usually a dusky blotch on the last rays of the dorsal. Virginia to Louisiana, in streams coastwise; abundant, replacing the true *auritus* in the streams of the Southern States.

(*Pomotis solis* Cuv. & Val. vii, 468: *Ichthelis rubricauda* Holbrook, Ichth. S. C. 1860, 15; McKay, Proc. U. S. Nat. Mus. iv, 89.)

cc. Gill-rakers weak and flexible, very short; palatine teeth none. (*Xenotis** Jordan.)

747. L. megalotis (Raf.) Cope.—*Long-eared Sun-fish.*

Body short and deep, compressed, the back very strongly arched; the profile very steep, usually forming an angle above eye, but sometimes full and convex. Mouth small, oblique, the premaxillary rather below the eye, the maxillary extending to opposite middle of eye. Scales on cheek rather large, in about 5 rows. Dorsal spines very low, not much longer than the snout. Opercular flap in the adult very long and broad, with a broad or narrow pale blue or red margin, the margin sometimes

* Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 76: type *Pomotis fallax* B. & G. (ξενος, wonderful; ους, ear.)

very broad, sometimes almost wanting; the flap half or more longer than the eye in the adult, much shorter in the young, its development subject to great variation. Brilliant blue and orange; the back chiefly blue; the belly entirely orange, the orange on the sides in spots, the blue in wavy vertical streaks; lips blue; cheeks orange, with bright-blue stripes; blue stripes before eye; iris red; soft parts of vertical fins with the rays blue and the membranes orange; ventrals dusky. Head without flap, 3 in length; depth $1\frac{2}{3}$–$2\frac{1}{2}$. D. X, 10; A. III, 8; scales 5–38–14. L. 6 inches. Michigan to Minnesota, South Carolina, and Mexico; very abundant in most streams. One of our most brightly-colored fishes. Extremely variable: the young are often elliptical in form, and the size at which the characteristic ear-flap is developed varies greatly with different individuals. We have thus far failed to distinguish any tangible varieties. Some Southern specimens have the ear-flap longer (*fallax*); some Northern ones have the scales rather larger (*inscriptus*), or the margin of the ear-flap broader than usual (*peltastes*), or wanting altogether (*lythrochloris*). Some Southern specimens (*breviceps*) have a dusky spot on the last rays of dorsal. These characters gradually disappear on examination of a large series.

(*Ichthelis megalotis* Raf. Ichth. Oh. 1820,29: *Xenotis megalotis* Jordan, Man. Vert. ed. 2, 242: *Ichthelis aurita* Raf. Ich. Oh. 1820, 29, not *Labrus auritus* L.: *Lepomis auritus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 220: *Xenotis lythrochloris* Jordan, Bull, U. S. Nat. Mus. x, 40: *Pomotis nitida* Kirtland, Bost. Journ. Nat. Hist. iii, 472: *Pomotis fallax* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 24: *Pomotis fallax* Girard, U. S. Pac. R. R. Surv. Fish. 27: *Pomotis rubricauda* Günther, i, 262: *Pomotis breviceps* B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390: *Pomotis popei* Girard, U. S. Pac. R. R. Surv. Fish. x, 26: *Pomotis sanguinolentus* Agass. Amer. Journ. Sci. Arts, 1854, 302: *Xenotis solis* Jordan, Bull. U. S. Nat. Mus. x, 22, not *Pomotis solis* C. & V.: *Pomotis convexifrons* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 24: *Xenotis aureolus* Jordan, Bull. U. S. Nat. Mus. x, 41: *Pomotis inscriptus* Agassiz, Amer. Journ. Sci. Arts, 1854, 302: *Xenotis inscriptus* Jordan, Bull. U. S. Nat. Mus. x, 42: *Lepomis peltastes* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 454; McKay, Proc. U. S. Nat. Mus. iv, 89.)

748. L. marginatus (Holbr.) McKay.

Body short and deep. Snout shorter than the diameter of the eye, the maxillary extending to the orbit. Paired fins rather long. Color olive, with darker vertical bars; head and body with numerous bluish-green spots; opercular appendix bordered with green. Head 3; depth 2. D. (IX) X, 12; A. III, 10. Florida. (*Holbrook.*)

(*Pomotis marginatus* Holbr. Journ. Acad. Nat. Sci. Phila. 1855, 49: *Pomotis marginatus* Günther, i, 264.)

749. L. bombifrons (Agass.) Jor.

Body rather short and deep, with the profile very steep and the back very much arched, the greatest depth of the body being over the

opercles; opercular flap very small, unmargined. Eye large; a slight angle in front of the eye. Gill-rakers unknown. Mouth moderate, placed very low; the premaxillaries entirely below the eye; maxillary extending back to the middle of the pupil. Dorsal spines moderate, the last ones somewhat shortened. Anal fin large; pectorals and ventrals reaching anal. Scales of cheek in 5 rows. Light brown; fins pale, unspotted. Scales of belly and sides dotted with golden orange. Head $2\frac{3}{4}$; depth $2\frac{1}{8}$. D. X, —; A. III, —; scales 5–?–11. L. 4 inches. (*Agassiz.*) Tennessee River. Known to us from the original description and from a tracing of a drawing received from Professor Bliss.

(*Pomotis bombifrons* Agassiz, Amer. Journ. Sci. Arts, 1854, 303.)

aaa. Supplementary maxillary obsolete; gill-rakers slender, rather stiff. (*Helioperca** Jordan.)

d. Palatine teeth present.

750. L. humilis (Grd.) Cope.—*Red-spotted Sunfish.*

Body oblong. Scales large. Spines rather high. Profile not very steep. Eye $3\frac{1}{2}$ in head; mucous pores on head very large; opercular flap rather long, broad, with a very broad red margin which entirely surrounds the black. Gill-rakers rather long, blunt, 8–10, well developed; cheeks with about 5 rows of scales. Bluish, with conspicuous greenish spots and mottlings posteriorly; sides with many conspicuous round salmon-red spots; usually a faint black spot on last rays of dorsal; belly and lower fins red. Head $2\frac{3}{4}$; depth $2\frac{1}{4}$. D. X, 11; A. III, 9; scales 5–34–11. L. 3 inches. Kentucky to Kansas and Texas; locally abundant; a small, highly-colored species.

(*Bryttus humilis* Girard, Proc. Acad. Nat. Sci. Phila. 1857, 201; Girard, U. S. Pac. R. R. Surv. Fish. 1858, 21: *Lepomis anagallinus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 221: *Lepomis anagallinus* Jordan, Man. Vert. ed. 3, 240: ? *Bryttus oculatus*† Cope, Proc. Acad. Nat. Sci. Phila. 1865, 83: ? *Lepomis oculatus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 221.

dd. Palatine teeth none; a black blotch on last rays of dorsal.

751. L. pallidus (Mitch.) Gill & Jor.—*Blue Sunfish; Copper-nosed Bream; Dollardee.*

Body comparatively short and deep, compressed; the young slender, the adult nearly orbicular. Caudal peduncle rather slender. Head not

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*Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 355: type *Labrus pallidus* Mitch. (ἡλιον, sun; περκη, perch.)

†*L. oculatus* Cope.

Similar to *L. humilis*, but the body deeper, the caudal peduncle and fin forming but one-third of the length. Head short; opercular flap long, with a black spot as large as eye, surrounded by a broad pale margin; body without red spots. Depth $2\frac{1}{3}$. Scales 5–32–11. L. 3. (*Cope.*) Minnesota.

large, the projecting snout usually forming an angle above eye. Mouth quite small, oblique, the jaws about equal, the maxillary barely reaching the front of the eye. Five rows of scales on cheeks. Opercular flap very short in the young; in the adult rather long and wide, without pale edge. Gill-rakers moderately long, nearly terete, bent slightly downwards, about 10 well developed. Dorsal spines strong and high, usually longer than snout and eye. Ventral fins reaching anal; pectorals reaching past anal spines. Olive green; adults dark; young more or less silvery, with a purple lustre in life; sides with undulating, often chain-like, transverse greenish bars, which become obsolete in the adult; no blue stripes on cheeks; a diffuse black blotch at base of posterior rays of dorsal and anal, often obscure in young; no red on fins; very old specimens often with the belly coppery red. Head 3; depth 2. D. X, 11; A. III, 10; Lat. l. 44. L. 8 inches. Great Lakes to Florida and Mexico; very abundant; one of our most widely diffused and variable species.

(*Labrus palladus* Mitchill, Trans. Lit. & Phil. Soc. N. Y. 1815, 407; Jordan, Man. Vert. 241: *Labrus appendix* Mitchill, Amer. Month. Mag. 247, 1818 (not *Pomotis appendix* of authors): *Pomotis incisor* C. & V. vii, 466: *Pomotis incisor* Günther, i, 269: *Ichthelis incisor* Holbrook, Ichth. S. C. 12: *Pomotis gibbosus* C. & V. vii, 467: *Pomotis speciosus*, and *aquilensis* B. & G. Proc. Acad. Nat. Sci. Phila. 1854, 24: *Pomotis speciosus* Günther, i, 263: *Pomotis luna* Grd. U. S. Pac. R. R. Surv. Fish. x, 22: *Lepomis longispinis*, *megalotis*, and *ardesiacus* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 220, 222: *Lepomis purpurascens* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 453: *Pomotis obscurus** Agassiz, Amer. Journ. Sci. Arts, 1854, 302: *Lepiopomus obscurus* Jordan, Ann. Lyc. Nat. Hist. 1876, 317, a deeply colored variety, from the Tennessee Basin and southward.)

aa. Pharyngeal teeth mostly bluntly conic. (*Xystroplites*† Jordan.)

752. L. heros (B. & G.) McKay.

Appearance of *Lepomis pallidus*. Body robust, deep; the front steep, the projecting snout forming a considerable angle at the eye. Caudal peduncle rather long. Mouth moderate. Eye large. Scales on cheeks in 4 or 5 rows. Opercular flap broad, about as large as eye, with an orange margin below and behind. Spines strong and rather high.

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*The life colors of "*Lepomis obscurus*" are as follows:

Dark green above, the shoulders and front of back with distinct greenish-black spots; sides with wide dark-green bars; chest bright coppery-red, spotted with blackish and orange; sides of belly with blackish and carmine; face, lower jaw, and lower parts of head of a peculiar bright leaden blue; cheeks orange and lead-blue, not striped; opercular spot large, all black; vertical fins dark blue-green; a black spot on last rays of dorsal and anal.

†Jordan MSS. Cope, Proc. Amer. Philos. Soc. 1877, 66: type *Xystroplites gillii* Jordan = *Bryttus albulus* Grd. (ξυδτρον, a scraper—gill-raker; ὁπλιτης, armed.)

Pectoral fins long. Olivaceous, plain in spirits; belly silvery; cheeks not striped; usually a faint spot on last rays of dorsal, and sometimes of anal also. Head $2\frac{3}{4}$; depth 2. D. X, 12; A. III, 11; scales 5–39–15. Texas; one specimen known; distinguishable from *Lepomis pallidus* only by the blunt teeth.

(*Pomotis heros* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1854, 25: *Pomotis heros* Grd. U. S. Mex. Bound. Surv. Ichth. 6: *Xystroplites heros* Jordan, Man. Vert. ed. 2, 244.)

753. L. cyryorus McKay.

Body very robust, compressed; form nearly oval; dorsal outline more convex than ventral; profile steep, convex. Mouth oblique, small; maxillary reaching front of eye. Outer teeth stronger than others; teeth on front of palatines. Lower pharyngeals with the rather long posterior spur turned up, stoutish; the inner angle rounded, somewhat obtuse. Teeth stout, very much blunted, not close set; the inner considerably stronger and less blunt than the rest. Gill rakers short, stout, about eight in number, the inner surface roughened. Maxillary with a small but perfectly distinct supplemental bone. Eye very small, considerably less than length of snout. Scales on cheeks in 6–7 rows. Opercular flap nearly as long as snout, surrounded by a very broad, paler, membranous margin; scales on the opercle large, in 5 rows. Dorsal spines low, the longest as long as from snout to eye; much lower than soft rays. Caudal peduncle and fin short and broad; ventrals and pectorals short, reaching vent. Scales on breast larger than those on cheeks. Head $3\frac{3}{4}$; depth $2\frac{2}{5}$. D. X, 11; A. III, 10; scales 6–43–14. L. $6\frac{2}{3}$ inches. Lake Huron; one specimen known.

(McKay, Proc. U. S. Nat. Mus. 1881, 89.)

754. L. albulus (Grd.) McKay.

Body elongate, rather deep mesially. Caudal peduncle rather elongate. Snout projecting, forming an angle above eye. Mouth wide, the lower jaw projecting; maxillary reaching just past front of pupil. Eye as long as opercular flap, $4\frac{1}{2}$ in head; flap moderate, broad, with a very wide pale edge below and behind. Dorsal spines moderate, as long as snout and half of orbit. Five rows of scales on cheek. Lower pharyngeal teeth blunt, almost paved. Light olive, uniform in spirits; traces of dusky mottlings on last rays of dorsal and anal. Head $2\frac{1}{2}$; depth 2. D. X, 10; A. III, 9; scales 6–42–13. L. 5 inches. Florida to

Texas; not common; like the preceding species, intermediate between *Lepomis* proper and *Eupomotis.*

(*Bryttus albulus* Grd. Proc. Acad. Nat. Sci. Phila. 1857; Girard, U. S. Pac. R. R. Surv. x, 19: *Bryttus albulus* Günther, i, 259: *Xystroplites gilli* Jordan, Bull. U. S. Nat. Mus. x, 24, 1877; McKay, Proc. U. S. Nat Mus. 1881, 89.)

** Lower pharyngeals broad; pharyngeal teeth paved, subspherical in form, truncate above. (*Eupomotis* Gill & Jordan.*)

755. L. holbrooki (Cuv. & Val.) McKay.

Body robust, elevated, the snout rather produced. Eye large, 4 in head; maxillary reaching front of orbit. Dorsal fin high, the spines about as high as the soft rays; pectoral fins very long. Cheeks with 5 rows of scales. Gill-rakers rather long, obtuse, strongly toothed. Opercular flap short,broad, with a broad orange margin below and behind. No palatine teeth; pharyngeal teeth paved. Dusky olive, silvery below; throat yellow; fins dark, with yellowish rays; no black dorsal spot. Head $3\frac{2}{3}$; depth $2\frac{1}{4}$. D. X, 12; A. III, 11. L. 10 inches. South Carolina to Florida; abundant.

(*Pomotis holbrooki* Cuv. & Val. vii, 466, 1831: *Pomotis speciosus* Holbr. Journ. Acad. Nat. Sci. Phila. 1855, 48: *Pomotis microlophus* Günther, i, 264: ?*Xystroplites longimanus* Cope, Proc. Amer. Phil. Soc. Phila. 1877, 66: *Eupomotis holbrooki* Jordan, Proc. U. S. Nat. Mus. ii, 1879, 224.)

756. L. notatus (Agass.) McKay.

Body robust, elongate, the snout projecting, the profile scarcely gibbous. Mouth rather wide, oblique, reaching the front of eye. Eye rather large. Opercular flap wide and rounded, shorter than in *L. gibbosus*, with a rather wide pale border all around. Scales very large; 4 rows on cheek. Spines rather high and strong, the longest dorsal spine as long as from muzzle past middle of pupil. Soft fins high. Gill-rakers short and not very stiff. Pharyngeal teeth paved. Color pale olive, mottled; a faint dorsal spot. Head 3; depth $2\frac{1}{8}$; D. X, 11; A. III, 11; scales 4–35–13. L. 8 inches. Illinois to Alabama.

(*Pomotis notatus* Ag. Amer. Journ. Sci. Arts, 1854, 302: *Eupomotis pallidus* Jordan, Bull. U. S. Nat. Mus. x, 21, 1877; not *Pomotis pallidus* Agass.)

757. L. gibbosus (L.) McKay.—*Common Sun-fish; Bream; Pumpkin-seed; Sunny.*

Body short and deep, compressed, the profile steep, convex; usually an angle above the eye. Head rather small. Mouth small, oblique, the maxillary scarcely reaching the front of the eye. Dorsal spines rather high, as long as eye and snout; the soft rays higher. Pectorals

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*Gill & Jordan, Field and Forest, 1877, ii, 190: type *Sparus aureus* Walbaum = *Perca gibbosa* L. (ευ, well; πῶμα, opercle; ους, ear.)

long. Scales large; 4 rows on cheek. Pharyngeal teeth all truncate, paved. Color greenish-olive above, shaded with bluish, the sides spotted and blotched with orange; belly orange-yellow; cheeks orange, with blue wavy streaks; lower fins orange, upper bluish and orange-spotted. Opercular flap rather small, the lower posterior part always bright scarlet, a mark which distinguishes this species when adult at once from all our other high-colored sun-fishes. Head $3\frac{1}{4}$; depth 2. D. X, 11; A. III, 10; Lat. l. 47. L. 8 inches. Great Lake region to Maine and southward to Florida, east of the Alleghanies; found only in the northern parts of the Mississippi Valley. One of our most abundant and familiar fishes.

(*Perca gibbosa* L. Syst. Nat. ed. xi, 293, 1760 (after *Perca fluviatilis gibbosa, ventre luteo*, of Catesby): *Sparus aureus* Walb., Artedi, Pisc. 1792, 290 (after "Goldfisch" of Schöpff): *Pomotis vulgaris* Cuv. & Val. iii, 91, 1829: *Morone maculata* Mitchill, Report, in part, Fish. N. Y. 1814, 18: *Pomotis vulgaris* Holbr. Ichth. S. Car. 8: *Pomotis vulgaris* Storer, Fish. Mass. 12: *Pomotis auritus* Günther, i, 261: *Eupomotis aureus* Jordan, Man. Vert. 241.)

758. L. lirus McKay.

"This species resembles *P. incisor* (*L. pallidus*) in the outline of the body, the nature and coloration of the scales, and in the size and form of the fins, but it differs greatly from it by its large mouth, the free extremity of the upper jaws reaching the vertical line of the middle of the eye, by the presence of teeth upon the palate, and by the ventral fins being placed immediately under the pectorals. The black opercular appendage, which is very short, has a narrow orange border behind; there is a black spot at the base of the posterior rays of the dorsal; both dorsal and anal are marked by one or two dark stripes; the caudal is crossed by several dotted vertical lines; there are eight or nine dusky bars across the sides between the head and tail. This species bears the same relation to *Pomotis* that *Pomoxis* bears to the true *Centrarchus* in the size of the mouth and the form of the body, and I have no doubt it will some day become the type of a distinct genus." (*Agassiz.*) Tennessee River, at Huntsville, Ala. We are informed by Professor Bliss that the types of this species have the pharyngeals paved.

(*Pomotis pallidus* Agassiz, Amer. Journ. Sci. Arts, 1854, 303, not *Labrus pallidus* Mitch.; McKay, Proc. U. S. Nat. Mus. 1881, 89.)

251.—MICROPTERUS Lacépède.

Black Bass.

(*Huro* and *Grystes* Cuvier and Valenciennes: *Calliurus*, *Dioplites*, *Lepomis*, etc., Rafinesque.)

(Lacépède, Hist. Nat. Poiss. iv, 325, 1802: type *Micropterus dolomieu* Lac.)

Body elongate-ovate, compressed, the back not much elevated. Head oblong-conic. Mouth very large, oblique, the broad maxillary reaching nearly to or beyond the posterior margin of the eye, its supplemental bone well developed. Lower jaw prominent. Teeth on jaws, vomer, and palatines; usually none on the tongue. Preopercle entire; operculum ending in two flat points, without cartilaginous flap. Branchiostegals normally 6. Scales rather small, weakly ctenoid. Lateral line continuous. Dorsal fin divided by a deep notch, the spines low and rather feeble, 10 in number; anal spines 3; the anal fin much smaller than the dorsal; caudal fin emarginate. Size large. Two species, among the most important of American "game-fishes." (*μικρος*, small; *πτερον*, fin; the dorsal fin in the typical specimen having been injured, its posterior rays, detached and bitten off short, were taken by Lacépède for a separate fin.)

a. Mouth very large, the maxillary in the adult extending beyond the orbit; scales rather large, 65–70 in the lateral line; 7–8 series above lateral line.

759. M. salmoides (Lac.) Henshall.—*Large-mouthed Black Bass; Oswego Bass; Green Bass; Bayou Bass.*

Body ovate-fusiform, becoming deeper with age, moderately compressed. Head large. Mouth very wide, the maxillary in the adult reaching beyond the eye; in the young shorter. Scales on the cheek in about 10 rows; scales on the trunk comparatively large. Lingual teeth sometimes present. Dorsal fin very deeply notched. Coloration of the young dark-green above; sides and below greenish-silvery; a blackish stripe along the sides from opercle to the middle of the caudal fin; three dark oblique stripes across the cheeks and opercles; below and above the lateral band some dark spots; caudal fin pale at base, then blackish, whitish at tip; belly white. As the fish grows older the black lateral band breaks up and grows fainter, and the color becomes more and more of a uniform pale dull green, the back being darker; a dark opercular blotch usually present. Head $3\frac{1}{4}$; depth 3. D. X, 13; A. III, 11; scales 8–68–16. L. 1–2 feet. Rivers of the United States, from the Great Lakes and Red River of the North to Florida and Texas; everywhere abundant, preferring lakes, bayous,

and sluggish waters. It grows to a larger size than the next species, and is readily distinguished by its coloration and the larger mouth and larger scales. Both species vary much with different waters.

(*Labrus salmoides* Lacépède, Hist. Nat. Poiss. iv, 716, 1802: *Lepomis pallida* Raf. Ichth. Oh. 30, 1820; Jordan, Ann. Lyc. Nat. Hist. xi, 314, 1877: *Cichla floridana* Le Sueur, Journ. Acad. Nat. Sci. Phila. 1822, 220: *Huro nigricans* C. & V. ii, 124: *Huro nigricans* Günther, i, 255: *Micropterus nigricans* Gill, Proc. Amer. Assoc. Adv. Sci. 1873, 70 (and of most late writers): *Dioplites nuecensis* Grd. U. S. Mex. Bound. Ichth. 3: *Micropterus salmoides* Henshall, Book of the Black Bass, 1881, 110.)

aa. Mouth smaller, the maxillary in the adult not extending beyond orbit; scales smaller, 72–75 in the lateral line; 10–12 series above the lateral line.

760. M. dolomieu Lac.—*Small-mouthed Black Bass.*

Body ovate-fusiform, becoming deeper with age. Head large. Mouth large, but smaller than in *M. salmoides*, the maxillary ending considerably in front of the hinder margin of the orbit. Scales on the cheek minute, in about 17 rows; scales on the trunk comparatively small. Dorsal fin deeply notched, but less so than in *M. salmoides*, the ninth spine being about half as long as the longest, and not much shorter than the tenth. Coloration quite variable, the young dull golden green, with bronze lustre; darker spots along the sides, which tend to form short vertical bars, but never a dark lateral band; 3 bronze bands radiating from eye across cheeks and opercles; a dusky spot on point of operculum; belly white; caudal fin yellowish at base, then black, with white tips; dorsal with bronze spots, its edge dusky. In some waters the fin-markings are obsolete, but usually they are very conspicuous in the young. Southern specimens usually have the scales of the lower part of the sides with faint dark streaks; adult specimens have all these marks more or less wholly obliterated, and become ultimately of a uniform dead-green, without silvery lustre. Head $3\frac{1}{2}$; depth $3\frac{1}{3}$. D. X, 13; A. III, 10 or 11; scales 11–74–17. Rivers of the United States, from the Great Lake region to South Carolina and Arkansas; abundant, frequenting running streams, and preferring clear and cool waters; its southern limit is bounded by the presence of such waters. As a game fish this species is usually more highly valued than its congener.*

(Lacépède, Hist. Nat. Poiss, iv, 325, 1802; Henshall, Book of the Black Bass, 1881, 84: *Bodianus achigan* Raf. Amer. Monthly Mag. & Crit. Rev. ii, 120, 1817: *Grystes salmoides* C. & V. iii, 54: *Grystes salmonoides* Günther, i, 252: *Micropterus salmoides* Gill, Proc. Amer. Assoc. Adv. Sci. 1873, 67, and of many American writers: *Calliurus punctulatus* Raf. Ichth. Oh. 26: *Grystes fasciatus* Günther, i, 258: *Centrarchus obscurus* Günther, i, 258.)

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*Both this species and the preceding are popularly known in the Southern States by the grossly erroneous name of "Trout."

Family LXXXV.—PERCIDÆ.

(*The Perches.*)

Body more or less elongate, terete or compressed, covered more or less completely with rather small, ctenoid, adherent scales. Lateral line usually present, not extending on the caudal fin. Mouth terminal or inferior, small or large, the premaxillaries protractile or not; maxillaries large or small, without distinct supplemental bone. Jaws, vomer, and palatines with bands of teeth, which are usually villiform, but sometimes mixed with canines; occasionally the teeth on the vomer or palatines are absent. Head naked, or more or less scaly; preopercle entire or serrate; opercles usually ending in a flat spine. Branchiostegals 6 or 7. Gills 4, a slit behind the fourth; gill-membranes free or connected, not joined to the isthmus; gill-rakers slender, toothed; pseudobranchiæ small, or glandular and concealed, or altogether wanting; lower pharyngeals separate, with sharp teeth. Fins generally large; two dorsals, the first of 6 to 15 spines; anal fin with one or two spines (three in *Percichthys*, a fresh-water genus from Chili). Ventrals thoracic, I, 5; pectorals often very large; caudal lunate, truncate or rounded. Anal papilla often present. Air bladder small and adherent, often entirely wanting. Pyloric cœca few. Vertebræ, 30 to 45.

Genera about 22; species, 90 to 100; inhabitants of the fresh waters of cool regions, most of them being American and nearly all belonging to the fauna of the United States. The great majority of the species belong to the sub-family of *Etheostomatinæ*, the Darters, all the species of which group are American. They are among the most singular and interesting of our fishes. They differ from the typical *Percinæ* in their small size, bright colors, and large fins, and more technically in the rudimentary condition of the pseudobranchiæ and the air bladder, both of which organs are usually inappreciable. The preopercle is unarmed, and the number of branchiostegals is six. An anal papilla is likewise developed, as in the *Gobiidæ*, to which group the Darters bear a considerable superficial resemblance, which, however, indicates no real affinity. The relations of the Darters to the Perches have been aptly expressed by Professor S. A. Forbes:

"Given a supply of certain kinds of food nearly inaccessible to the ordinary fish, it is to be expected that some fishes would become especially fitted for its utilization. Thus the *Etheostomatinæ* as a group

are explained in a word by the hypothesis of the progressive adaptation of the young of certain *Percidæ* to a peculiar place of refuge and a peculiarly situated food supply. Perhaps we may without violence call these the mountaineers among fishes. Forced from the populous and fertile valleys of the river beds and lake bottoms, they have taken refuge from their enemies in the rocky highlands, where the free waters play in ceaseless torrents, and there they have wrested from stubborn nature a meager living. Although diminished in size by their constant struggle with the elements, they have developed an activity and hardihood, a vigor of life and a glow of high color almost unknown among the easier livers of the lower lands. * * * Notwithstanding their trivial size, they do not seem to be dwarfed so much as concentrated fishes." (Am. Nat. 1880, October, pp. 697–702.)

The colors of the *Etheostomatinæ* are usually very brilliant, species of *Pœcilichthys*, *Nothonotus*, and *Diplesium* being among the most brilliantly colored fishes known; the sexual differences are often great, the females being as a rule dull in color and more speckled or barred than the males. Most of them prefer clear running water, where they lie on the bottom concealed under stones, darting, when frightened or hungry, with great velocity, for a short distance, by a powerful movement of the fan-shaped pectorals, then stopping as suddenly. They rarely use the caudal fin in swimming, and they are seldom seen moving or floating freely in the water like most fishes. When at rest, they support themselves on their expanded ventrals and anal fin. All of them can turn the head from side to side, and they frequently lie with the head in a curved position or partly on one side of the body. The species of *Ammocrypta* and perhaps some of the others prefer a sandy bottom, where, by a sudden plunge, the fish buries itself in the sand and remains quiescent for hours at a time, with only its eyes and snout visible. The others lurk in stony places, under rocks and weeds. Although more than usually tenacious of vitality, the Darters, from their bottom life, are the first to be disturbed by impurities in the water. All the Darters are carnivorous, feeding chiefly on the larvæ of *Diptera*, and in their way voracious. All are of small size; the largest (*Percina*) reaches a length of 8 inches, while the smallest (*Microperca*) is probably the smallest spiny-rayed fish known, barely attaining the length of an inch and a half. They are of too small size to be used for food, although, according to Rafinesque, "they are good to eat, fried."

The *Percinæ* are represented in America by two genera, and in Europe by the same two and three others—*Acerina*, *Percarina*, and *Aspro*—the

latter bearing a strong external resemblance to the *Etheostomatinæ*, and serving as a connecting link between them and the more typical forms.

(*Percidæ* part, Günther, i, 58-78; genera *Perca*, *Lucioperca*, *Pileoma*, *Boleosoma*, *Acerina*, *Percarina*, *Aspro*, *Percichthys*, and *Percilia*.)

* Anal spines one or two.
a. Pseudobranchiæ imperfect or wanting; preopercle entire; branchiostegals 6. (*Etheostomatinæ*.)
b. Premaxillaries protractile.
c. Body extremely elongate, subcylindrical, translucent, the belly at least naked; lateral line complete; gill-membranes broadly united.
d. Anal spine single; anal fin nearly as large as second dorsal. AMMOCRYPTA, 252.
dd. Anal spines two; anal fin small ..... IOA, 253.
cc. Body less elongate, opaque, chiefly scaled.
e. Anal spine obscure, normally single.
f. Lateral line complete, or wanting on a few scales only .. BOLEOSOMA, 254.
ff. Lateral line incomplete ..... VAILLANTIA, 255.
ee. Anal spines two, the first commonly the longer.
g. Gill-membranes more or less broadly united; belly with ordinary scales.
h. Maxillary bone normal ..... ULOCENTRA, 256.
hh. Maxillary adnate to the preorbital ..... DIPLESIUM, 257.
gg. Gill-membranes scarcely connected.
i. Belly with enlarged caducous plates ..... COTTOGASTER, 258.
ii. Belly without enlarged caducous plates ..... IMOSTOMA, 259.
bb. Premaxillaries not protractile.
j. Lateral line complete.
k. Ventral line with a series of enlarged, spinous, caducous scales or (if these are fallen) a naked strip.
l. Mouth small, inferior, beneath a pig-like snout .. PERCINA, 260.
ll. Mouth larger, the snout not projecting beyond it. ALVORDIUS, 261.
kk. Ventral line without caducous scales.
m. Gill-membranes scarcely connected.
n. Anal fin larger than second dorsal . HADROPTERUS, 262.
nn. Anal fin smaller than second dorsal .. NOTHONOTUS, 263.
mm. Gill-membranes broadly connected ... NANOSTOMA, 264.
jj. Lateral line present, incomplete.
o. Gill-membranes broadly united .... ETHEOSTOMA, 265.
oo. Gill-membranes separate or nearly so. PŒCILICHTHYS, 266.
jjj. Lateral line obsolete ..... MICROPERCA, 267.
aa. Pseudobranchiæ well developed; preopercle serrate; branchiostegals 7. (*Percinæ*.)
p. Canine teeth none; body oblong ..... PERCA, 268.
pp. Canine teeth in jaws and palatines; body elongate. STIZOSTEDIUM, 269.

252.—AMMOCRYPTA Jordan.

Sand Darters.

(* *Pleurolepis* Agassiz; not *Pleurolepis* Egerton, a genus of extinct Ganoids.)

(Jordan, Bull. U. S. Nat. Mus. x, 6, 1877: type *Ammocrypta beani* Jordan.)

Body slender and elongate, sub-cylindrical; pellucid in life. Head

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* Agassiz, Bull. Mus. Comp. Zoöl. i, 5, 1863: type *Etheostoma pellucidum* Baird MSS.

slender. Mouth rather wide, terminal, horizontal, the lower jaw included; premaxillaries very protractile; teeth on the vomer. Scales thin, ctenoid, little imbricated, present along the region of the lateral line and on the tail, sometimes wanting on the back or belly; lateral line complete. Head scaly or naked; no ventral plates; the belly naked. Gill-membranes considerably united, forming an angle at their junction. Dorsal fins moderate, about equal to the anal fin and to each other; dorsal with about ten spines; anal spine single, weak. Vertebræ 22 + 22 (*A. pellucida*). Darters of moderate or rather large size, inhabiting the sandy bottoms of clear streams, where they bury themselves entirely excepting the eyes and snout. Coloration translucent, with bright reflections. (*αμμος*, sand; *κρυπτος*, concealed.)

a. Cheeks and opercles naked; body imperfectly scaled.

761. A. beani Jordan.

Body greatly elongated, sub-cylindrical, transparent. Head rather large, heavier than in *A. pellucida*. Mouth rather wide, nearly terminal; the upper jaw somewhat the longer; outer teeth strong, hooked. Opercular spine obsolete. Head entirely naked. Body naked, except the caudal peduncle, which is sparsely covered with thin, imbedded scales, and a series of rather large scales along the sides, on which the lateral line runs. Dorsal fins high, wide apart, about equal in height to the anal fin and to each other; caudal fin emarginate. Color translucent, without bars or spots, the lateral line shining-golden in life. Spinous dorsal with a large black spot on the membrane anteriorly, another near the middle, and some small ones behind; other fins with their membranes dusted with dark points. Head $3\frac{3}{4}$; depth $7\frac{1}{2}$. D. X–10; A. I, 9; Lat. l. 65. L. $2\frac{1}{2}$ inches. Louisiana and Mississippi.

(*Ammocrypta beanii* Jordan, Bull. U. S. Nat. Mus. x, 5, 1877: *Ammocrypta gelida* Hay, Proc. U. S. Nat. Mus. 1880, 490—apparently the young; the size smaller and the fins lower.)

aa. Cheeks and opercles scaly.

762. A. pellucida (Baird) J. & G.—*Sand Darter.*

Translucent; scales with fine black dots; a series of small, squarish olive or bluish blotches along the back and another along each side; lateral spots connected by a gilt band. Body slender; head stout. Cheeks, opercles, and temporal region scaled; the scales imbedded and more or less cycloid. Neck above thinly scaled or naked; scales of body not very rough, those along lateral line and caudal peduncle most closely imbricated; belly entirely naked; opercle ending in a short, flat

spine. Maxillary barely reaching to opposite the large eye; eyes high up, separated by a narrow, grooved space. Pectorals short, reaching tips of ventrals, half way to vent. Head $4\frac{1}{2}$; depth 7. D. X–10; A. I, 8; Lat. l. about 75, about 6 series of scales above it. L. 3 inches. Ohio valley and northwestward; abounding in clear sandy streams; one of the most interesting of our fishes.

(*Etheostoma pellucidum* Baird MSS.: *Pleurolepis pellucidus* Agassiz, Bull. Mus. Comp. Zoöl. i, 5, 1863: *Pleurolepis pellucidus* Vaillant, Recherches sur Etheostom. in Nouv. Archiv. Mus. 1874, 138: *Pleurolepis pellucidus* Jordan, Man. Vert. ed. 2, 219: *Pleurolepis pellucidus* Jordan & Copeland, Amer. Nat. 1877, 86.)

763. A. asprella Jordan.

Head long, rather slender. Eyes very large, high up and very close together. Mouth not large, sub-terminal, horizontal. Cheeks and opercles with pectinated scales. Opercular spine well developed. Squamation much more complete than in *A. pellucida*, the scales small and quite rough, largest posteriorly. Throat and belly naked, the space between the ventral fins scaled. Back of neck scaly. Fins large, the dorsals well separated; the spinous high, highest in front; second dorsal smaller, smaller than anal; anal spine high, flexible; caudal lunate. Coloration clear olivaceous, sides with 8 to 10 dark squarish blotches, quite small and far apart; a blackish shade forward from eye, and a dusky shade across opercle. Said to present in life "almost all the colors of the rainbow." Head $4\frac{1}{5}$; depth 8. D. IX–10; A. I, 8; Lat. l. 98, ten series above the lateral line. L. 4 inches. Illinois to Alabama, in sandy streams; a much larger and rougher species than the preceding.

(*Pleurolepis asprellus* Jordan, Bull. Ills. Lab. Nat. Hist. 2, 38, 1878: *Pleurolepis asprellus* Jordan, Man. Vert. ed. 2, 404.)

253.—IOA Jordan & Brayton.

(Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 88, 1878: type *Pœcilichthys vitreus* Cope.)

This genus differs from *Ammocrypta* chiefly in the presence of two well-developed spines in the anal fin. The anal fin is proportionately smaller, and the scales are larger and rougher, more fully covering the body. The squamation of the head is more complete than in any other genus. Species slender, translucent in life. (ἰος, an arrow or dart.)

764. I. vitrea (Cope) J. & B.

Form of *Ammocrypta*. Head slender, acuminate; mouth not very small; temporal region scaled; cheeks and opercles covered with large, imbricated, very roughly ctenoid scales, these scales extending forward to the maxillary and backward to edge of opercle and on subopercle;

the feeble opercular spine is almost hidden by them. Middle and lower part of the sides of the body covered with large, imbricated, very rough scales, these less closely set below; breast naked; behind the ventrals the middle line of the belly with some small scales, behind which is a naked space bounded by small imbedded scales, and extending as far as the vent; back from middle of first dorsal forward naked, posteriorly more or less scaly. Fins low and small, the second dorsal larger than the first or the anal; the spines slender; anal spines short; pectoral fins long and narrow. Translucent, with small dark spots on back and sides, besides finer specklings; fins plain. Head $4\frac{1}{2}$; depth 7. D. VII to IX–11 to 13; A. II, 6 to 8; Lat. l. 60. L. 2 inches. Neuse River, North Carolina; locally abundant.

(*Pœcilichthys vitreus* Cope, Proc. Amer. Philos. Soc. Phila. 1870, 263; Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 82, 1878.)

254.—BOLEOSOMA DeKay.

Tessellated Darters.

(*Arlina* and *Estrella* Grd.)

(DeKay, New York Fauna Fish. 1842, 20: type *Boleosoma tessellatum* DeKay = *Etheostoma olmstedi* Storer.)

Body moderately elongate, fusiform, not translucent. Head small, narrowed forwards, the profile convex. Mouth small, horizontal, the lower jaw included; premaxillaries protractile. Maxillary not adnate to preorbital. Vomerine teeth present. Scales large. Lateral line continuous (rarely wanting on two or three scales). Belly with ordinary scales. Gill-membranes narrowly connected. Dorsal spines 7–10, slender; soft dorsal much larger than anal; anal normally with a single, short, slender spine, the first soft ray simple, but articulate. Vertebræ (*B. nigrum*) 17 + 20. Coloration olivaceous and speckled, the males blackish in spring. Size small. (βολις, a dart; σῶμα, body.)

a. Dorsal spines normally 9.
  b. Cheeks scaly; second dorsal with 13 or 14 rays ..... *olmstedi.*
  bb. Cheeks and breast normally naked (occasionally fully scaled).
    c. Body fusiform, with slender caudal peduncle; fins moderate; second dorsal with 11 or 12 rays; lateral line usually not quite complete ..... *nigrum.*
    cc. Body robust, compressed; fins very high.
      d. Second dorsal with 13 rays; lateral line with about 40 scales ..... *effulgens.*
      dd. Second dorsal with 10 rays; lateral line about 35 ..... *vexillare.*
aa. Dorsal spines 7 (?) ..... *æsopus.*

a. Dorsal spines normally 9.

b. Cheeks scaly; second dorsal with 13 or 14 rays.

765. B. olmstedi (Storer) Agassiz.

Body slender, little compressed, with long caudal peduncle. Head slender, rather pointed. Cheeks and opercles scaly; space before dorsal naked; breast naked. Fins very high, pectorals reaching past tips of ventrals. Coloration olivaceous, tessellated above; sides with blotches and zigzag markings; fins speckled or somewhat barred; head not speckled, dusky in males; usually a black stripe forward from the eye and another downward. Head 4; depth 5½. D. IX–14; A. I, 9; Lat. l. 50. L. 3½ inches. Great Lakes to Georgia and Massachusetts; the commonest eastern species. A southern form, var. *maculaticeps*, has the cheeks scaly above only, and is more speckled; var. *atromaculatum*, found eastward, has the breast closely scaled.

(*Etheostoma olmstedi* Storer, Bost. Journ. Nat. Hist. 1842, 61: *Boleosoma tessellatum* DeKay, New York Fauna Fish. 1842, 20; Agassiz, Lake Superior, 299; Günther, i, 77; Cope, Journ. Acad. Nat. Sci. Phila. 1868, 213; Vaillant, l. c. 79: *Boleosoma maculaticeps* Cope, Proc. Amer. Philos. Soc. 1870, 269: *Estrella atromaculata* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 66.)

bb. Cheeks and breast (normally) naked.

d. Body fusiform, with slender caudal peduncle; fins moderate; second dorsal with 11 or 12 rays; lateral line usually not quite complete.

766. B. nigrum (Raf.) Jor.—*Johnny Darter.*

Body fusiform, slender. Head conical, moderate, the snout somewhat decurved. Mouth small, lower jaw included. Cheeks and breast naked (specimens occasionally found with these regions closely scaly); opercles scaly; space before dorsal mostly scaled. Fins high, but smaller and lower than in the other species. Coloration pale olivaceous; back much tessellated with brown; sides with numerous small W-shaped blotches; head speckled above, mostly black in the males; a black line forward from eye, and sometimes a line downward also; fins barred; males in the spring blackish anteriorly, sometimes almost entirely black. Tubes of the lateral line obsolete on the last 4 or 5 scales. Head 4⅛; depth 5. D. IX–12; A. I, 8; scales 5–51–9. L. 2½ inches. Ohio Valley, Great Lake region, and Upper Mississippi; very abundant where found. It perhaps varies into *B. olmstedi*, but may be distinguished, as far as we have seen, by the shorter dorsal.

(*Etheostoma nigra* Raf. Ichth. Oh. 1820, 37: *Boleosoma maculatum* Agassiz, Lake Superior, 1850, 305: *Boleosoma brevipinne* Cope, Proc. Amer. Philos. Soc. 1870, 268; Günther, i, 77: *Boleosoma mutatum* Vaillant, l. c. 88: ? *Pœcilichthys mesœus* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 232: *Boleosoma maculatum* Jordan, Man. Vert. ed. 2, 224.)

dd. Body robust, compressed; fins very high.

e. Second dorsal with 13 rays; lateral line about 40.

767. B. effulgens (Grd.) Cope.

Body rather slender; caudal peduncle not contracted; opercular spines rudimental; muzzle abruptly decurved. Eye $3\frac{3}{4}$ in head. Fins very high; caudal very much rounded; ventrals reaching anal; pectorals still longer. Color brown, with traces of nine spots on the side; muzzle, chin, and spot below the eye black; fins black, the second dorsal and caudal with white specks. Head $4\frac{1}{5}$; depth $6\frac{1}{4}$. D. IX–13; A. II, 8; scales 5–40–6. L. $2\frac{1}{2}$ inches. Maryland to North Carolina. (*Cope.*)

(*Arlina effulgens* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 64; Cope, Proc. Am. Philos. Soc. 1870, 269.)

ee. Second dorsal with 10 rays; lat. l. about 35.

768. B. vexillare Jordan.

Body rather short and stout; caudal peduncle not contracted; opercular spine moderately developed; space in front of dorsal fin naked; muzzle moderately decurved; eye moderate. Second dorsal very high, higher than long; pectorals and ventrals long, nearly reaching anal. Coloration olivaceous, the sides with traces of vertical bars; first dorsal, ventrals, and anal black; second dorsal and caudal strongly barred with pale in fine pattern; head black in the male; lateral line complete. Head 4; depth $4\frac{2}{3}$. D. VIII–10; A. I, 7; scales 4–35–6. L. $2\frac{1}{4}$ inches. Rappahannock River, Warrenton, Va.; a single specimen known.

(Jordan, Proc. U. S. Nat. Mus. 1880, 237.)

aa. Dorsal spines 7.

769. B. æsopus Cope.

Body stout, the back rather elevated; the caudal peduncle somewhat contracted; muzzle somewhat decurved; mouth terminal. Dorsal fins much elevated. Color light brown, with six small dark dorsal spots, and ten similar small spots along the dorsal line; a bar around muzzle and one below eye. D. VII–14; A. 10; scales 5–47–8. L. $2\frac{1}{4}$ inches. Loyalsoc Creek, a tributary of Allegheny River. (*Cope.*) One specimen known, perhaps an accidental variation.

(Cope, Proc. Am. Philos. Soc. Phila. 1870, 270.)

255.—VAILLANTIA Jordan.

(Jordan, Bull. U. S Nat. Mus. xii, 89, 1878; type *Boleosoma camurum* Forbes.)

This genus agrees with *Boleosoma* in all respects, except that the lateral line is incomplete, usually ceasing near the middle of the body. (To Léon Vaillant, author of an excellent monograph of these fishes.)

770. V. camura (Forbes) Jor.

Body slender, elongate, with long caudal peduncle. Back somewhat elevated. Head small, rather slender, the snout shorter than eye, strongly decurved. Mouth inferior, horizontal, small, the maxiliary extending to the middle of the eye. Gill-membranes little connected. Cheeks, opercles, and breast closely covered with rather large scales; median line of neck naked; opercular spine strong; scales moderate; lateral line quite short, nearly straight, reaching to the middle of the spinous dorsal, developed on 20 to 30 scales. Fins small, the dorsals well apart; first dorsal larger than the second, which is larger than the small anal. Coloration as in *Boleosoma*, olivaceous, the back spotted and tessellated; sides with about ten irregular spots; a dark spot on opercles. Head spotty above; a black line across the muzzle; no bar below eye; dorsals and caudal fin finely barred. Head $4\frac{1}{3}$; depth $5\frac{1}{2}$. D. X–10; A. I, 8; scales 5–56–10. L. $2\frac{1}{4}$ inches. Rivers of Illinois.

(*Boleosoma camura* Forbes, Bull. Ills. Lab. Nat. Hist. ii, 40, 1878.)

771. V. chlorosoma Hay.

Body slender, compressed, the dorsal region much arched. Caudal peduncle long and slender, the body abruptly contracted at the vent. Head small, convex in profile. Cheeks and opercles scaled. Breast scaled or naked. Dorsals separated by a distance equal to half the head, about equal to each other, larger than the anal. Lateral line developed on 4 to 20 scales. Greenish yellow, with many blotches and zigzag markings of brown; a row of about 10 of these blotches along each side, most distinct on caudal peduncle; about 8 square brown dorsal spots. Top of head, opercular spot, and subocular spot, black. A black streak from eye to snout. Head $4\frac{1}{2}$; depth $5\frac{1}{4}$. D. IX–11; A. I, 7 or I, 8; Lat. l 50 to 60. L. 2 inches. Eastern Mississippi; apparently not different from the preceding.

(Hay, Proc. U. S Nat. Mus. 1880, 495.)

256.—ULOCENTRA Jordan.

(Jordan, Man. Vert. E. U. S. ed. 2, 223, 1878; type *Arlina atripinnis* Jor.)

Body moderately elongate, little compressed. Head short, thick, with tumid cheeks. Mouth small, horizontal, the lower jaw included. Premaxillaries protractile, little movable; maxillary movable, not joined to the preorbital except at its root; vomerine teeth present, small. Gill-membranes more or less broadly connected. Scales moderate. No ventral plates. Lateral line complete or incomplete. First dorsal with 12

spines; anal smaller than second dorsal, with two well-developed spines, the first the longer. Small species, rather brightly colored. (*ουλος*, complete; *κεντρον*, spine; the development of the anal spines distinguishing it from *Boleosoma*.)

a. Lateral line incomplete.

772. U. phlox (Cope) J. & G.

Vermillion red, with faint small brown dorsal spots; a series of similar blue spots along the lateral line. Spinous dorsal with a dark blue border; second dorsal with a dark shade; caudal cross-barred. Body rather stout. Head compressed. Mouth terminal, the premaxillaries freely protractile; opercular spine strong. Cheeks and opercles naked. Breast and neck scaleless or nearly so. Scales rather large, the belly scaled like the sides. Gill-membranes not described. Lateral line straight, reaching middle of second dorsal. Anal fin small, other fins large. D. X–12; A. II, 5; scales 5–52–8. L. 2 inches. Trinity River, Texas. (*Cope*.)

(*Boleosoma phlox* Cope, Bull. U. S. Nat. Mus. xvii, 30, 1880.)

773. U. stigmæa Jordan.—*Speck*.

Body slender, formed as in *Boleosoma*. Head narrow and thin, the snout somewhat pointed, obliquely truncate in profile. Mouth narrow, horizontal, subinferior, its cleft nearly reaching eye; premaxillaries little protractile. Lateral line extending to opposite middle of second dorsal. Scales rather large. Opercles, cheeks, and neck scaly; breast naked. Gill-membranes not very broadly joined; opercular spine sharp. Fins rather large; caudal emarginate. Olivaceous, tessellated and speckled above; sides with about 8 W-shaped dark green blotches below the lateral line and various duller ones above; upper parts in the larger specimens sprinkled with small orange spots, which are more conspicuous after death, when the green has faded. Fins mottled; spinous dorsal with a band of orange-red above, and one or two narrow dark ones below it. A dark stripe forward and another downward from eye. Head $4\frac{1}{4}$; depth 5. D. X–12; A. II, 7; scales 5–46–7. L. $2\frac{1}{2}$ inches. Georgia to Louisiana; rather common in the ponds and streams of the hill country.

(*Boleosoma stigmæum* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 311.)

aa. Lateral line complete.

774. U. atripinnis Jordan.

Body rather short, somewhat compressed behind. Head extremely short and deep, the snout very short and abruptly rounded, as in *Diplesium*. Eye large. Mouth small, with equal jaws. Cheeks and oper-

cles scaly; the cheek scales small and closely set; a triangular series of scales on temporal region; throat smooth; neck above closely scaly; belly closely scaled. Fins large; spinous dorsal high, the second still higher, but smaller than the first, its base about equal to the length of the head; dorsal fins contiguous, slightly connected. Color olivaceous; head above entirely black; back with 8 dark cross-bars; about 11 bar-like blotches, somewhat indistinct, arranged along the lateral line; fins chiefly black; membranes of the second dorsal and ventral fins entirely black, that of the spinous dorsal with a broad black horizontal bar at base, above which are numerous distinct black oblique streaks; anal with a broad black bar; caudal and pectoral fins largely dusky. Females and young probably paler. Head $4\frac{1}{8}$; depth $4\frac{1}{2}$. D. XII–10; A. II, 7; Lat. l. (not counted). L. $2\frac{1}{2}$ inches. Cumberland River; but one specimen known.

(*Arlina atripinnis* Jordan, Bull. U. S. Nat. Mus. 1877, 10; Jordan, Man. Vert. ed. 2, 223.)

775. U. simotera (Cope) Jordan.

Body short and rather deep. Head small; the snout very obtuse, as blunt as in *Diplesium*. Cheeks, opercles, and breast scaly. Dorsal fins well separated. Back and sides each with a series of quadrate blackish-green blotches; belly saffron-color; upper parts sprinkled with red spots; first dorsal margined with orange-red; a row of oval red spots across the middle of the fin; second dorsal with the membrane chiefly blood-red; a black spot on occiput and opercle; a dark stripe downward and one forward from eye; caudal fin brown, barred. Head 5; depth 4. D. X–11; A. II, 7; scales 10–52–12. L. 3 inches. Headwaters of the Tennessee and Cumberland rivers; an elegant and peculiar species, carrying to an extreme the gobioid appearance of these fishes.

(*Hyostoma simoterum* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 215: *Hyostoma simoterum* Vaillant Recherches, 100: *Diplesium simoterum* Jordan, Man. Vert. ed. 2, 223.)

257.—DIPLESIUM Rafinesque.

(*Hyostoma* Agassiz.)

(*Diplesion* Rafinesque, Ichth. Oh. 1820, 37; type *Etheostoma blennioides* Raf.)

Body elongate, subterete. Head very short and blunt, with tumid cheeks; the profile very convex. Mouth small, inferior, horizontal. Premaxillaries protractile, little movable, joined to the forehead mesially by a slight frenum; maxillary not protractile, adnate for most of its length to the fleshy skin of the preorbital; lower jaw very short; teeth

in jaws strong; no teeth on vomer or palatines. Gill-membranes broadly connected. Scales moderate, rough. Lateral line complete; no enlarged ventral plates. Dorsal fins large, the spinous dorsal longer and lower than the second, of about 13 spines; anal smaller than second dorsal with 2 strong spines. Vertebræ (*D. blennioides*) 19 + 22. Coloration largely green. (δις, two; πλέσιον, near; dorsal fin nearly divided in two.)

776. D. blennioides (Raf.) Jor.—*Green-sided Darter.*

Body stout, elongate, little compressed; profile very convex. Eyes large, high up and close together; a longitudinal furrow between the eyes. Mouth small, horizontal, quite inferior; upper jaw concealed in a furrow under the snout. Scales moderate; those on the belly large, not caducous; cheeks with fine scales; opercles with large ones; neck scaly; chest naked. Anal papilla very large. Anal spines strong; caudal fin emarginate; lower rays of the pectorals, and the rays of the ventrals and anal enlarged and fleshy in the males. Color olive green, tessellated above; sides with about eight double transverse bars, each pair forming a Y-shaped figure; these are sometimes joined above, forming a sort of wavy lateral band; in life these markings are of a clear deep green; sides sprinkled with orange dots; head with olive stripes and the usual dark bars; first dorsal dark orange brown at base, blue above, becoming pale at tip; second dorsal and anal of a rich blue green, with some reddish; caudal greenish, faintly barred; young and female specimens are more or less dull, but the pattern is peculiar. Head $4\frac{1}{2}$; depth $4\frac{3}{4}$. D. XIII–13; A. II, 8; Lat. l. 65 to 78. L. 3–5 inches. Pennsylvania to Kansas, south to Alabama; one of the handsomest and most abundant of the Darters.

(*Etheostoma blennioides* Raf. Journ. de Physique, 1819, 419: *Pileoma cymatogramma* Abbott, Proc. Acad. Nat. Sci. Phila. 1860, 327: *Hyostoma cymatogrammum* Vaillant, l. c. 102; Jordan, Man. Vert. 222: *Hyostoma blennioperca* Cope (Journ. Acad. Nat. Sci. Phila. 1868, 214) is a form larger than usual and with rather smaller scales: *Hyostoma newmani* Agassiz (Am. Journ. Sci. Arts, 1854, 305) is slenderer, with rather larger scales on the body and on the cheeks. Both grade into the common form.)

258.—COTTOGASTER Putnam.

(*Rheocrypta* Jordan.)

(Putnam, Bull. Mus. Comp. Zoöl. 1863, 5: type *Boleosoma tessellatum* Thompson, not of DeKay.)

Body rather robust, little compressed. Head moderate, bluntish. Mouth small, the lower jaw included; premaxillaries protractile; maxillary not adherent to the preorbital. Teeth on vomer. Gill-membranes nearly separate. Scales ctenoid; those of the middle line of the belly

enlarged and spinous, falling off at times, leaving a naked strip; lateral line continuous. Dorsal fins large, the second usually smaller than the first and smaller than the anal. Anal spines two, strong, the first the longer. Size moderate.

(*κοττος*, sculpin; *γαστήρ*, belly.)

777. C. copelandi Jordan.

Body rather slender and elongate. Head rather large and long, somewhat narrowed, resembling that of *Boleosoma*. Mouth small, horizontal, subinferior. Eye large, $3\frac{1}{3}$ in head. Cheeks naked; opercles and neck each with a few scales; throat naked. Ventral plates well developed; scales moderate, strongly ctenoid. Color brownish olive; a series of rather small, horizontally-oblong, black blotches along the lateral line, forming an interrupted lateral band; back tessellated; blackish streaks forward and downward from eye; ventral fins dusky in the male; vertical fins with dusky specks; a black spot on anterior rays of spinous dorsal. Head $4\frac{1}{4}$; depth $5\frac{1}{2}$. D. XI-10; A. II, 9; Lat. l. 56. L. $2\frac{1}{2}$ inches. White River, Indiana; abundant near Indianapolis.

(*Rheocrypta copelandi* Jordan, Bull. U. S. Nat. Mus. X, 9, 1877: *Rheocrypta copelandi* Jordan, Man. Vert. 222.)

778. C. putnami J. & G. (nom. sp. nov.).

General form of the preceding. Mouth large, the maxillary reaching to the pupil. Snout convex. Cheeks naked; opercles closely scaled; chest naked; neck above scaly; scales large. Tessellated above; sides with ten square blotches, which are small and slightly connected by a dusky band; spinous dorsal with a brown median band; second dorsal and caudal barred; entral in the males dusky; a dusky stripe downward and one forward from eye. Head 4; depth 6. D. XI–11; A. II, 8; Lat. l. 44. L. 3 inches. Lake Champlain. (Described from No. 1314, U. S. Nat. Mus.)

(*Boleosoma tessellatum* Thompson, Appendix Hist. Vermont, 1853, 31; not of Dekay: *Cottogaster tessellatus* Putnam, Bull. Mus. Comp. Zool. 1863, 5.)

259.—IMOSTOMA Jordan.

(Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 49: type *Hadropterus shumardi* Grd.)

Body robust. Head large. Mouth comparatively large, horizontal, the lower jaw included; premaxillaries protractile; maxillary not adnate to preorbital. Belly without caducous plates. Fins as in *Alvordius*, the anal larger than the second dorsal. (*ειμι*, to move; *στόμα*, mouth.)

779. I. shumardi (Grd.) Jordan.

Body stout, heavy forward, compressed behind. Head broad and

thick. Eye large, $3\frac{1}{2}$ in head. Mouth large and broad, the lower jaw wide, a little shorter than the upper; maxillary reaching to the eye. Cheeks, opercles, and neck scaly; chest naked; belly naked anteriorly, scaly for a distance in front of the vent; scales rather large. Dorsal fins large, the first larger than the second, which is smaller than the anal, though longer; the two dorsal fins well separated; anal fin large, very deep, in some specimens (males?) reaching to the caudal; anal spines strong, the first the larger. Color dark, densely but vaguely blotched with darker; sides with 8–10 obscure blotches, the anterior ones bar-like; a large black spot on base of spinous dorsal behind, and a small one in front; second dorsal, caudal, and pectorals barred; a very strong black suborbital bar, and a faint dark line along muzzle. Head $3\frac{2}{5}$; depth 5. D. X–15; A. II, 11; scales 6–56–11. L. 3 inches. Wabash, Illinois, and Arkansas Rivers.

(*Hadropterus shumardi* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 100; Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 49; Jordan, Man. Vert. 222.)

260.—PERCINA Haldeman.

Log Perches.

(*Pileoma* DeKay.)

(Haldeman, Journ. Acad. Nat. Sci. Phila. viii, 330, 1842: type *Perca nebulosa* Hald. = *Sciæna caprodes* Raf.)

Body elongate, slightly compressed, covered with small ctenoid scales. Lateral line continuous; ventral line with enlarged plates, which fall off, leaving a naked strip. Head depressed, rather pointed, the mouth being small and inferior, overlapped by a tapering, subtruncate, pig-like snout; upper jaw not protractile. Teeth on vomer and palatines. Gill-membranes scarcely connected. Dorsal fins well separated, the first the larger, of 13–15 spines; the second dorsal rather longer than the anal, which has two spines, the first of which is usually the shorter. Air-bladder and pseudobranchiæ present, rudimentary. Vertebræ (*P. caprodes*) 19 + 22. General pattern of coloration olivaceous, with dark vertical bands alternately long and short. (A diminutive of *Perca*.)

780. P. caprodes (Raf.) Grd.—*Log Perch; Rock-fish; Hog-molly; Hog-fish.*

Body elongate, compressed. Head long and pointed, depressed and sloping above. Mouth small, quite inferior, the maxillary not reaching nearly to the front of the eye. Cheeks, opercles, and neck scaly; chest naked. Fins rather low. Color yellowish-green, with about 15 transverse dark bands from the back to the belly, these usually alternating with shorter and fainter ones, which reach about to the lateral

line; a black spot at the base of the caudal; fins barred. Head 4; depth 6. D. XV–15; A. II, 9; Lat. l. 92. L. 6–8 inches. Great Lakes and streams of the South and West; the largest of the darters.

(*Sciæna caprodes* Rafinesque, Amer. Month. Mag. 1818, 534: *Pileoma semifasciatum* DeKay, New York Fauna Fish. 1842, 16: *Etheostoma caprodes, nebulosa, semifasciata,* and *bimaculata* Storer, Synop. Fish. N. A. 270–272; Girard, Proc. Acad. Nat. Sci. Phila. 1859, 66: *Pileoma semifasciatum* Günther, i, 76: *Pileoma caprodes* Vaillant l. c. 43; Jordan, Man. Vert. 220: *Pileoma carbonaria* Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 387: *Pileoma carbonaria* Günther, i, 76: *Pileoma carbonaria* Girard, 1859, 10: *Percina carbonaria* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 67; the latter a variety from Texas with the fins mostly higher.)

Var. **manitou** Jordan.

Space in front of spinous dorsal naked; lateral bars short, more or less confluent, each one not meeting its fellow of the other side across the back; otherwise essentially as in the preceding, with which it intergrades. Chiefly northwestward; abundant in Wisconsin. Examples intermediate between *caprodes* and *manitou* from Potomac River (*Bean; Jouy*) and Illinois (*Forbes*).

(*Percina manitou* Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 53.)

261.—ALVORDIUS Girard.

Black-sided Darters.

(*Etheostoma* Agassiz; not of Rafinesque.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 68: type *Alvordius maculatus* Girard.)

Body rather elongate, little compressed. Mouth rather wide, terminal, the lower jaw included, the snout above not protruding beyond the premaxillaries, which are not protractile. Teeth on vomer, and usually on palatines also. Gill-membranes separate. Scales small, ctenoid, covering the body. Belly with a median series of enlarged spinous plates, which fall off, leaving a naked strip; sides of head scaly or not. Lateral line complete. Fins large, the soft dorsal smaller than the spinous or the anal. Anal spines 2; dorsal spines 10–15. Vertebræ 22 + 22 (*A. aspro*); 17 + 22 (*A. evides*). Coloration bright; sides with dark blotches. The most active and graceful of the darters.

(Dedicated to Maj. B. Alvord, who discovered "*Alvordius maculatus*" at Fort Gratiot, on Lake Huron.)

a. Vertebræ more than 40; dorsal spines 11 to 15; palatine teeth present. (*Alvordius.*)

b. Cheeks, opercles, and ante-dorsal region entirely scaleless; head very long and large; lat. l. 75–80 ..... *macrocephalus.*

bb. Cheeks covered with fine scales; opercles with larger ones.

c. Head very slender, with long acuminate muzzle; jaws nearly equal; space before dorsal scaled; lat. l. 65–70; lateral blotches small, quadrate. *phoxocephalus.*

cc. Head stouter, with wider muzzle; lower jaw included ..... *aspro, nevisensis.*

bbb. Cheeks naked; opercles scaly above only; space before dorsal naked; muzzle blunt.

d. Ventral shields moderate; colors dull, plain ..... *crassus.*

dd. Ventral shields very large, 4 or 5 times the size of the ordinary scales; colors brilliant ..... *variatus.*

aa. Vertebræ less than 40; dorsal spines 10 or 11; palatine teeth obsolete; males with the lower fins tuberculate in spring. (*Ericosma* Jordan.) .... *evides, fasciatus.*

a. Vertebræ more than 40; dorsal spines 11 to 15; palatine teeth present. (*Alvordius.*)

b. Cheeks and opercles entirely scaleless; head very long and large; lat. l. 75 to 80.

781. A. macrocephalus (Cope) Jor.

Body elongate. Head long and large; mouth rather large, maxillary reaching to opposite anterior margin of orbit. Eye shorter than snout, 4½ in head. Ventral shields twice as large as other scales. Head, neck, and chest without scales. Color light brown, with a slightly undulating whitish band from upper angle of opercle to caudal peduncle; back with dark quadrate spots; sides with 9 blackish longitudinal spots, alternating with smaller ones; streaks downward and forward from eye; vertical fins somewhat barred; spinous dorsal with a median blackish band; head spotted above. Head 3½; depth 7. D. XV–13; A. II, 11; scales 11–77–15. L. 3 inches. Ohio Valley; not very common.

(*Etheostoma macrocephalum* Cope, Trans. Am. Philos. Soc. 1866, 401; Jordan, Man. Vert. ed. 2, 220.)

bb. Cheeks covered with fine scales; opercles with larger ones.

c. Head very slender, with long acuminate muzzle; jaws nearly equal; space before dorsal scaled; lat. l. 65 to 70; lateral blotches small, quadrate.

782. A. phoxocephalus (Nelson) Cope & Jordan.

Body rather slender, compressed. Head extremely long, narrow and tapering, the snout very acuminate. Mouth large, the maxillary reaching to the eye; the lower jaw unusually narrow and long, scarcely shorter than upper. Eye about equal to snout, 4¼ in head. Cheeks, opercles, and neck with small scales; chest naked. Color yellowish brown, somewhat as in *A. aspro*, but the lateral spots smaller and more numerous, quadrate in form; a small blackish spot at each end of the lateral line. Head 4; depth 5½. D. XII–13; A. II, 9; scales 12–68–14. L. 4 inches. Indiana to Kansas; not common.

(*Etheostoma phoxocephalum* Nelson, Bull. Ills. Mus. Nat. Hist. i, 35, 1876; Jordan, Man. Vert. Ed. 2d, 221.)

cc. Head stouter, with wider muzzle; lower jaw included.

783. A. aspro Cope & Jordan—*Black-sided Darter.*

Body rather elongate, fusiform, compressed behind. Head moderately elongate, less pointed than in some of the species. Mouth moderate, the lower jaw included; maxillary reaching just past the front of the eye. Eye about equal to snout, 4 in head. Gill-membranes little con-

nected. Lateral line straight, prolonged forwards to the eye. Opercles with rather large scales; cheeks covered with very small ones, which are scarcely visible; breast naked; neck naked, or more or less scaly; body otherwise entirely scaly, the scales small and rough. Straw-yellow or greenish, with dark tessellations and marblings above, and about 7 large dark blotches along the sides, which are partly confluent, thus forming a moniliform band; fins barred. Head 4; depth 6. D. XIII to XV–12; A. II, 9; scales 9–65–17. Ohio River to the Upper Missouri, chiefly northward; one of the most curious and elegant of the darters. Its coloration varies much in intensity with differences in surroundings. Specimens from the Ohio Valley slenderer than the typical form, with narrower head, scaly neck and paler colors, form a slight variety approaching *A. phoxocephalus.*

(*Etheostoma blennioides* Kirtland, Bost. Journ. Nat. Hist. 1839, 340—not of Rafinesque: *Etheostoma blennioides* Vaillant, l. c. 57; Cope & Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 51: *Alvordius maculatus* Jordan, Man. Vert. ed. 2, 220, probably not of Girard, who describes the head as scaleless.)

784. A. nevisensis (Cope) Jor.

"This is an elongate fish, with muzzle obtuse in profile, as well as wide, viewed from above. Cheeks, operculum, and middle dorsal line scaled. Ventral line without spinous scales; one only being present in the symphysis of the 'coracoids'. Anal fin with base a little shorter than spinous dorsal; the species may really be a *Pœcilichthys.* First dorsal moderately elevated; second, peculiar in spinous ray, well separated from the first dorsal. Caudal fin slightly forked. Ground color above yellowish, crossed by 9 dark chestnut quadrate spots on the median line, which are wider than their interspaces and are connected at their ends by an undulate chestnut band. Below the latter a similar longitudinal band on the anterior half of the body. Six quadrate black spots on the sides, with a small spot between each. A dark band from end of muzzle to scapula; below it on operculum, a silver spot. A black bar below eye. Belly white. Caudal and second dorsal distinctly, pectoral and ventral faintly black barred. A series of black spots along middle of first dorsal." Head $4\frac{1}{2}$; depth $4\frac{4}{5}$. D. XIII–I, 12; A. II, 8; scales 8–53–11. L. $3\frac{1}{4}$. (*Cope.*) Maryland to North Carolina.

(*Hadropterus maculatus** Grd, Proc. Acad. Nat. Sci. Phila. 1859; not *Alv. maculatus* Grd.: *Etheostoma nevisense* Cope, Proc. Amer. Philos. Soc. Phila. 1870, 261.)

bbb. Cheeks naked; opercles scaly above only; space before dorsal naked; muzzle blunt.

d. Ventral shields moderate; colors dull, plain.

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*The types of this species, lately examined by us, seem to be identical with *A. nerisensis;* cheeks with rather large scales; middle of breast with scales; ventral plates large. Scales 7–56–12. D. XIV–12; A. II, 9. Maryland.

785. A. crassus Jordan & Brayton.

Body stouter and more compressed than in *A. aspro*. Head stout; mouth as in *A. aspro*, the maxillary reaching front of eye. Outer teeth slightly enlarged. Cheeks entirely naked; opercles scaly; breast and anterior part of neck scaleless; ventral shields moderate. Coloration essentially as in *A. aspro*, the blotches rather faint and band-like. Depth 5; head 4. D. XI–12; A. II, 8; scales 7–54–7. L. 3–4 inches. Rivers of North and South Carolina.

(*Etheostoma maculatum* var. Cope, Proc. Acad. Nat. Sci. Phila. 1870, 261 (not *Hadropterus maculatus* Grd.); Jordan & Brayton, Bull. xii U. S. Nat. Mus. 1878, 12.)

dd. Ventral shields very large, 4 or 5 times the size of the ordinary scales; colors brilliant.

786. A. variatus (Kirt.) Jor.

Body moderately elongate; deeper than in *A. aspro*. Head rather short and stout. Mouth large, the maxillary reaching the eye; lower jaw scarcely shorter than upper; outer teeth somewhat enlarged. Eyes moderate, about as long as snout, $3\frac{1}{2}$ in head. Head naked, with the exception of a few scales on the upper anterior part of the opercle; neck and breast scaleless. Ventral shields larger than in any of the other species; four times as large as the other scales, 6 to 8 in number, with strong radiating points. Coloration bright olive, the back with short brown cross bars; the sides with broad brownish shades; black blotch on neck and on opercle; blackish bars downward and forward from eye; fins barred, the spinous dorsal with a black band. According to Dr. Kirtland, the males are further variegated with blue, green, and orange. Head $3\frac{3}{4}$; depth 5. D. XII–12; A. II, 8; scales 7–53–9. Ohio and Pennsylvania.

(*Ftheostoma variatum* Kirtland, Bost. Journ. Nat. Hist. 1840, 274: *Etheostoma peltatum* Stauffer MSS. Cope, Proc. Acad. Nat. Sci. Phila. 1854, p. 233: *? Alvordius maculatus* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 68: *Etheostoma peltatum* Vaillant, l. c. 61: *Alvordius peltatus* Jordan, l. c. 220.)

aa. Vertebræ less than 40; dorsal spines 10 or 11; palatine teeth obsolete; males with the lower fins tuberculate in spring. (*Ericosma** Jordan.)

787. A. evides Jordan & Copeland.

Body moderate, somewhat compressed. Head heavy, the profile rather convex. Eye rather large, high, $3\frac{1}{2}$ in head. Mouth moderate, somewhat oblique, the lower jaw included; maxillary reaching front of eye. Cheeks, neck above, and throat naked; Opercles with rather large scales; ventral plates little enlarged. Fins large; second dorsal lower

* *Ericosma* Jordan, Bull. U. S. Nat. Mus. x, 8, 1877: type *Alvordius evides* Jordan & Copeland; (ἦρ, spring-time; κοσμεω, to adorn.)

than anal, but with longer base. Coloration extremely brilliant; dark olivaceous above, tessellated with dark; sides with about 7 broad transverse bars extending from below the lateral line on one side across the back and down the other side; these bars are wider than the eye and are connected along the lateral line by a faint black stripe. In the female these bars are black and the intervening spaces yellowish. In the male the bars are of a dark rich blue-green with metallic lustre; the connecting longitudinal line greenish-bronze; just above this line is a luminous yellowish streak, and above in each of the interspaces between the bars is a bright blotch of bronze-red; entire lower parts of the body of a bright clear yellow, which becomes on the under side of the head, throat, and branchiostegals a bright orange-red; blackish green streaks downward and forward from eye; cheeks orange-red, the color of iron rust; dorsal fin orange-colored, with a bright bronze edge, a blackish spot on the last rays; second dorsal and caudal pale orange; two bright yellowish spots at base of caudal; anal bronze, with a blue-black shading; ventral fins dark blue-black; pectorals faintly orange. Males with the rays of the ventral and anal fins covered with small corneous tubercles, exactly as in some *Cyprinidæ*. Female and alcoholic specimens show little of the bright colors, although the same pattern is preserved. The spinous dorsal has a dusky spot on its posterior rays, and the fins are destitute of the dark bars found in the other species of *Alvordius*. Head $4\frac{1}{3}$; depth $5\frac{1}{3}$. D. XI–10; A. II, 8; scales 9–63–9. L. 2–3 inches. White River, Indiana; locally abundant; one of the most brilliant of fishes.

(*Alvordius evides* Jordan & Copeland, Proc. Acad. Nat. Sci. Phila. 1877, 51: *Ericosma evides* Jordan, Bull. U. S. Nat. Mus. x, 8, 1877.)

788. A. fasciatus (Grd.) Jor.

"It has the same blennioid aspect as its congener (*Alvordius aspro*); the total length of the specimens observed measuring about two inches and a quarter, the head entering in it four times and a half. The eye is of medium size, subcircular; the diameter being contained 4 times in the side of the head. The first dorsal is lower and longer than the second, to which it is contiguous. The anal is well developed, rather deeper than the second dorsal but shorter upon its base. The caudal fin is subtruncated. The ventrals and the pectorals are of moderate development, their tips being nearly even. The rays are D. X, 12; A. I, 8; the scales are small, deeper than long, posteriorly rounded off and minutely pectinated, whilst their anterior margin is truncated, exhibiting numerous radiating ridges upon the latter section only. Their im-

brication takes place after the fashion of the Sciænoids; instead of longitudinal series, they constitute transverse oblique series. As to the coloration, it is but imperfectly preserved. Transverse bands of deep chestnut alternate with white or yellowish ones. These bands or fasciæ are better defined below the lateral line than above it, where they are sometimes interrupted. The head is brown, with a vertical black streak across the orbits. The fins are yellowish, unicolor, except the first dorsal, which is margined with black. During life we imagine this fish to be one of the prettiest inhabitants of the fresh waters of this continent." (*Girard.*) Chihuahua River, Mexico. The types of this species are lost, but it is doubtless closely allied to *A. evides.*

(*Diplesion fasciatus* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 101.)

262.—HADROPTERUS Agassiz.

(*Hypohomus* Cope: *Plesioperca* Vaillant.)

(Agassiz, Amer. Journ. Sci. Arts, 1854, 305: type *Hadropterus nigrofasciatus* Ag.)

This genus differs from *Alvordius* only in the absence of the caducous ventral plates, the belly being covered with persistent scales, similar to those on the sides. (ἁδρός, strong; πτερόν, fin.)

a. Anal fin large, not smaller than the second dorsal.

b. Scales small, more than 75 in the lateral line; body elongate, little compressed; D. XV–15. (*Hypohomus** Cope.)

789. H. aurantiacus (Cope) Jor.

Form elongate; caudal peduncle slightly contracted; orbit smaller than length of muzzle, 4 in head, excluding the opercular spine; mandibles shorter than muzzle; cheeks and operculum covered with small scales; scales very small, covering the ventral line; gular region smooth; third dorsal ray longest, fin outline rapidly descending posteriorly; first anal ray below first of second dorsal; caudal fin even. Golden-brown above, with a series of small round brown spots nearer to the basis of the dorsal fin than the lateral line; the latter traversed by a broad black band, which passes on sides of head around muzzle; below bright citron-yellow; fins unspotted. Head $4\frac{1}{4}$; depth 6. D. XV–15; A. II, 11; Lat. l. about 85. L. $4\frac{1}{2}$ inches. (*Cope.*) Headwaters of Tennessee River.

(*Cottogaster aurantiacus* Cope, Journ. Acad. Nat. Sci. Phila. 1869, 211: *Hypohomus aurantiacus* Cope, Proc. Amer. Philos. Soc. 1870, 451: *Hadropterus aurantiacus* Jordan, Man. Vert. 221.)

bb. Scales large, less than 60 in the lateral line; body robust, more or less compressed; dorsal XII–12. (*Hadropterus*†.)

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* *Hypohomus* Cope, Proc. Amer. Philos. Soc. 1870, 451: type *Cottogaster aurantiacus* Cope. (ὑπω, below; ὁμος, uniform.)

† *Plesioperca,* Vaillant.

790. H. nigrofasciatus Agassiz.—*Crawl-a-bottom.*

Head and body stout and heavy, the body compressed. Mouth moderate, the maxillary reaching front of eye; eye moderate, 4 in head. Scales rather large. Fins all large. Breast usually naked, but sometimes closely scaled; scales on the median line of the belly somewhat enlarged, but not caducous nor especially spinous. Dark olive above, with blackish markings; sides with vertical bars, somewhat diamond-shaped, but quite narrow; these acute above and below, more or less confluent along the middle, about 12 in number; the bands dark greenish, varying to jet black, most distinct near the middle of the body and broadest behind; inner half of each of the vertical fins black; outer half more or less speckled and barred; top of head black, a black band through eye and snout, and a dark vertical shade below the eye; a small black spot between two smaller ones at base of caudal fin. Head 4; depth 5. D. XII–12; A. II, 10; scales 7–58–15. L. 4 inches. Rivers of the Southern States from South Carolina to Louisiana; one of the largest of the darters.

(Agassiz, Amer. Journ. Sci. Arts, xvii, 305, 1854; Jordan, Ann. Lyc. Nat. Hist. N. Y., 1877, 310: *Plesioperca anceps* Vaillant, l. c., 37: *Alvordius spillmani* Hay, Proc. U. S. Nat. Mus. 1880, 491, from Chickasawha River, Mississippi, specimens with the eye larger, the snout more pointed, the fins higher, and the color very dark.)

263.—NOTHONOTUS Agassiz.

Blue-breasted Darters.

(Agassiz, Bull. Mus. Comp. Zoöl. 1863, i, 3: type *Etheostoma maculatum* Kirtland.)

Body robust, or rather elongate, compressed. Mouth terminal, moderate; the lower jaw somewhat included; premaxillaries not protractile; maxillary movable. Teeth strong, present on vomer and palatines. Gill-membranes scarcely connected. Scales moderate or small, ctenoid; those of the middle line of the belly not enlarged, persistent. Lateral line well developed, nearly straight. Fins large, with strong spines; first dorsal longer and larger than the second with 10 to 15 spines; anal with two strong spines, the anterior usually the larger. Coloration often brilliant. (νοθος, prominent; νῶτος, back, in allusion to the large size of the dorsal fins, the name given in opposition to *Catonotus.*)

a. Head short, the muzzle abruptly decurved; lat. l. 52; dorsal spines 10 to 12; fins dark-edged.

791. N. camurus (Cope) Jor.—*Blue-breasted Darter.*

Body stout; head short; muzzle abruptly decurved, the mouth somewhat inferior; lower jaw included. Caudal broad, truncate. Males very

dark olive or blackish, with an obscure band of a paler shade; belly paler; breast and throat deep rich blue; sides profusely sprinkled with crimson dots; these spots sometimes arranged in short longitudinal series of threes and fours; series of olivaceous lines along the rows of scales; first dorsal with a black spot at base in front and a crimson one on the margin between the first and second rays; second dorsal, caudal, and anal crimson, bordered with yellow, which again is bordered with black or dark blue on the edge of the fin; the crimson is deepest next the yellow; pectoral and ventral fins with a broad red margin. Females less distinctly marked; olivaceous, somewhat barred. Head 4; depth $4\frac{1}{2}$. D. XI–13; A. II, 8; scales 7–53–8. L. $2\frac{1}{2}$ inches. Ohio to Tennessee in clear streams; one of the most elegant members of this most beautiful genus.

(*Pœcilichthys camurus* Cope, Proc. Am. Philos. Soc. Phila. 1870, 265: *Nothonotus camurus* Jordan, l. c. 225.)

aa. Head rather long and pointed; muzzle not decurved.
b. Dorsal spines 10 to 12.
c. Scales small; lateral line 55 to 65; fins not dark-edged.
d. Body slender.

792. N. sanguifluus (Cope) Jor.

Body elongate, with dorsal line not elevated, and the caudal peduncle very deep. Head flat, acuminate, the front descending very gradually, the mandible rising as gradually to its extremity; orbit rather large, equal to snout, 4 in head; end of maxillary reaching front of pupil; teeth of outer row larger. Fins generally, especially the caudal, short; latter slightly rounded; first dorsal much elongate; first anal spine very large. Coloration above black, shading to dark olive below, and with a narrow, wavy, leather-colored dorsal band; throat turquoise blue; sides and dorsal region marked with small circular spots of bright crimson, irregularly disposed, and in considerable number; first dorsal uncolored, with a black spot at base anteriorly and a dark shade through the middle; second dorsal blood-red, without border; caudal with two large crimson spots confluent on the middle line of the tail at its base, without border; pectorals and ventrals not red-bordered; females dull, with the fins black-barred and not crimson. Head 4; depth $5\frac{1}{4}$. D. XII–12; A. II, 9; scales 9–58–10. L. $2\frac{1}{2}$ inches. South Fork of Cumberland River, Tenn. (*Cope.*)

(*Pœcilichthys sanguifluus* Cope, Proc. Am. Philos. Soc. Phila. 1870, 264: *Nothonotus sanguifluus* Jordan, Man. Vert. 226.)

dd. Body comparatively deep, compressed.

793. N. maculatus (Kirtland) Ag.

Body moderately elongate, deep, and compressed. Head long and rather pointed. Mouth rather large; jaws equal. Dorsal fin elevated, the longest rays reaching caudal. Olive green; sides with rather large spots of brilliant carmine; vertical fins more or less barred with red and white. Head 4; depth $4\frac{2}{3}$. D. XII–13; A. II, 8; Lat. l. 60. L. $2\frac{1}{2}$ inches. Mahoning River, Ohio; not yet recognized elsewhere.

(*Etheostoma maculata* Kirtland, Bost. Journ. Nat. Hist. 1840, 276: *E. maculata* Storer, Synopsis, 270: *Nothonotus maculatus* Agassiz, Bull. M. C. Z. 1863, 3: *Nothonotus maculatus* Jordan, Man. Vert. 225.)

cc. Scales larger; lateral line 43 to 47; body stout.

794. N. rufilineatus (Cope) Jor.

Stout, the dorsal line elevated and descending regularly from the base of the first dorsal to the end of the muzzle. Muzzle short, regularly conic, about equal to eye, which is smaller than usual, $4\frac{1}{2}$ in head. Dorsal well developed; caudal peduncle deep; caudal fin small, truncate. Scales large. Color pale olive, with numerous narrow longitudinal lines, each on the adjacent margins of two rows of scales; these lines include a number of quadrate spots of a mahogany or brick-red color, which alternate with each other, but are not regular in position or number; pectoral region bright turquoise blue; belly bright reddish orange; head with two longitudinal mahogany-colored bands, and a spot of the same below the eye; five red spots on each side of the head, one on operculum, preoperculum, subopercuIum, and on each lip; fins all broadly crimson-bordered, the anal and caudal with narrow black edging; two orange areas at base of caudal; anal vermilion, with yellow base and black margin on posterior half. Females more olivaceous, obscurely barred and with the fins speckled. Head 4; depth $4\frac{1}{2}$. D. XI–12; A. II, 8; scales 6–45–7. L. 3 inches. French Broad River, Warm Springs, N. C. (*Cope.*)

(*Pœcilichthys rufilineatus* Cope, Proc. Am. Philos. Soc. Phila. 1870, 267.)

bb. Dorsal spines 14; scales small; lat. l. 53; back not arched.

795. N. vulneratus (Cope) Jor.

Body fusiform, stout. Caudal peduncle very deep. Dorsal outline scarcely arched; top of head gently and regularly curved to the end of the muzzle, much as in *N. sanguifluus*. Orbit four times in length of head, equal to muzzle. First dorsal not low; caudal truncate, rounded; anal small; scales small. Color light olive, with about eight vertical

dkar olive bars on the sides, which are interrupted above the lateral line; a few irregular crimson dots on the sides. Fins uniform, transparent, except the first dorsal and caudal; the former has a median series of red spots, the latter is pale orange, with a black margin; no cross-bars on fins in the male; second dorsal with a black margin. Head 4; depth 4½. D. XIV–13; A. II, 8; scales 8-53–9. L. 2 inches. French Broad River. (*Cope.*)

(*Pœcilichthys vulneratus* Cope, Proc. Am. Philos. Soc. Phila. 1870, 266.)

*** Species incompletely described.

The following species have not been recognized since their original description. They perhaps belong to *Nothonotus*.

796. N.? tessellatus (Storer).

"Body oblong. Head gibbous, less than one-fourth the length of the body. Lateral line straight. Top of the head and upper portion of the sides of a greenish-brown color; 8 or 10 transverse bluish bands on the sides; the intervals between these bands are yellowish, and in the centre of each is a bluish rhomb; a black blotch at the base of the tail; the lips, opercles, and rays of the first dorsal gamboge-yellow. D. XII–13; P. 13; V. I, 5; A. II, 10. L. 3 inches. Florence, Ala. Caught in running water." (*Storer.*)

(*Etheostoma tessellata* Storer, Proc. Bost. Soc. Nat. Hist. 1845: *E. tessellata* Storer, Synopsis, 273.)

797. N.? cinereus (Storer).

"Body oblong, compressed. Head gibbous directly over the eyes. The upper portion of the sides is of a light yellow color, crossed longitudinally by 3 or 4 cinereous interrupted narrow bands, one or two of which commence at the snout, the others back of the head, and are lost anterior to the tail; between these bands is a series of longitudinally-arranged oval blotches, of a similar color, and from these bands descend obliquely backward and downward to the abdomen narrow transverse lines; lower portion of the sides yellowish-white; first dorsal margined with red; second dorsal and anal variegated with red dots. D. XI–13; P. 15; V. I, 5; A. II, 8. L. 3–4 inches. Florence, Ala. Caught in deep, still water when fishing for perch." (*Storer.*)

(*Etheostoma cinerea* Storer, Proc. Bost. Soc. Nat. Hist. 1845: *E. cinerea* Storer, Synopsis 273.)

264.—NANOSTOMA Putnam.

(Putnam MSS. Jordan, Bull. U. S. Nat. Mus. x, 7, 1877: type *Pœcilichthys zonalis* Cope.)

Body fusiform, not greatly compressed. Mouth small, subinferior,

the premaxillaries not protractile. Vomerine teeth very feeble or wanting. Scales large. Gill-membranes broadly connected; no enlarged ventral plates. Lateral line complete. Dorsals well separated, the second larger than anal, higher and shorter than spinous dorsal; dorsal spines about 10; anal spines 2. (*νανος*, small; *στόμα*, mouth.)

a. Cheeks, opercles, and throat closely scaled.

798. N. zonale (Cope) Jor.

Body slender, somewhat compressed. Head small, rather short; the mouth small, subinferior. Snout decurved, rather obtuse, maxillary not reaching front of eye. Cheeks, opercles, neck, and throat closely scaled. Eye rather large. Teeth very feeble, those on the vomer not evident; probably none on the palatines. First dorsal well developed, separated from the second, which is higher and shorter than the spinous dorsal, and considerably larger than the anal; caudal emarginate. Bright olivaceous above, golden below; 6 dark-brown quadrate dorsal spots, which connect by alternating spots with a broad brown lateral band, from which 8 narrower dark-bluish bands more or less completely encircle the belly; paired, anal, and caudal fins golden, brown-spotted; middle half of the first dorsal crimson; a series of round crimson spots near the base of the second dorsal; occiput, a band on muzzle and one below eye black; a black spot on operculum and one at base of pectoral; females duller and speckled with ventrals barred and lateral bars feebler. Head $4\frac{1}{4}$; depth 5. D. XI–12; A. II, 7; scales 11–50–12. L. 3 inches. Mississippi Valley, in clear streams; rather rare.

(*Pœcilichthys zonalis* Cope, Journ. Acad. Nat. Sci. Phila. 1868, 212; Jordan, Man. Vert. 225: *Nanostoma vinctipes* Jordan, Bull. U. S. Nat. Mus. ii, 236, 1879; the female.)

799. N. elegans Hay.

Body stout, somewhat compressed. Head short and deep, with swollen cheeks. Snout abruptly decurved. Mouth subterminal, horizontal, small, the maxillary not reaching the front of the eye. Eye 4 in head. Lateral line nearly straight. Cheeks, opercles, and back of neck scaly; chest and region just behind ventrals naked. Spinous dorsal half as high as long, a little longer than the head; soft dorsal $\frac{5}{6}$ as long as head and $\frac{2}{3}$ as high as long; anal $\frac{3}{4}$ length of head, as high as long; pectoral fins very large, reaching beyond ventrals to vent. Color purplish; 6 large quadrate black blotches along back and 8 broad transverse bars along sides fainter, these alternating with dark spots; many of the scales above with jet-black spots forming longitudinal streaks; two black spots at base of caudal; a few black spots behind

eye; dark spots downward and forward from eye; ventral and anal fins indigo-blue; pectorals with blue; a bar of deep orange-red along base of both dorsals. Head 4; depth 5. D. X–12; A. II, 8; scales 5–42–6. L. $2\frac{1}{4}$ inches. Chickasawha River, Mississippi. (*Hay.*)

(Hay, Proc. U. S. Nat. Mus. 1880, 493.)

aa. Cheeks, opercles, and breast entirely scaleless.

800. N. thalassinum Jordan & Brayton.

Body rather stout, compressed behind, the back somewhat arched. Head large, the snout rather blunt and convex in profile. Eye large, high up, longer than muzzle, $3\frac{1}{2}$ in head; interorbital space rather narrow. Mouth moderate, slightly oblique, the maxillary reaching to the orbit. Upper jaw slightly longer than the lower. Head entirely naked; throat naked; neck naked anteriorly. Fins all large; membrane of the first dorsal continued to the base of the second; longest dorsal spine scarcely shorter than the soft rays, the base of the spinous dorsal a little longer than that of the soft dorsal; anal not much smaller than the soft dorsal, its first spine the longer; caudal fin deeply lunate; pectorals reaching nearly to vent. Male, in life, with the body dark green and blotched above; sides with 9 dark blue-green vertical bars, the five next the last most distinct; spinous dorsal reddish at base, then a broad black band, the uppermost third of a bright ferruginous red; second dorsal blackish at base, reddish above; caudal with 2 orange blotches at base, black mesially, pale orange distally; anal fin of a brilliant blue-green color at base, pale at tip; ventrals greenish; head mostly grass-green; the streaks forward and downward from eye dark green; females duller and more speckled. Head 4; depth 5. D. X–11; A. II, 8; scales 5–43–5. L. $2\frac{1}{2}$ inches. Saluda River, South Carolina; abundant.

(*Nothonotus thalassinus* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 13, 1878.)

801. N. tessellatum Jordan.

Color olivaceous, the markings obliterated in the type. Body fusiform. Head broad and heavy, entirely naked. Mouth moderate, horizontal, the lower jaw included, the maxillary extending to opposite front of eye. Anal higher than second dorsal, but not so long, its spines strong. Gill-membranes broadly united. D. X–12; A. II, 8; Lat. l. 48. L. $2\frac{1}{2}$ inches. Allegheny River; only the type (1199, U. S. Nat. Mus) now known.

(*Hadropterus tessellatus* Jordan, Bull. U. S. Nat. Mus. x, 7, 1877.)

802. N. inscriptum Jordan & Brayton.

Body rather stout and deep, strongly compressed. Caudal peduncle rather deep. Head large, rather obtuse, the profile quite gibbous, a considerable angle formed opposite the eyes, which are high up and close together. Eye about equal to snout, $3\frac{1}{2}$ in head. Mouth moderate, slightly oblique, the maxillary reaching eye, the upper jaw the longer. Head entirely scaleless; neck above scaly; breast naked; belly closely scaled; scales large. Fins large; spinous dorsal longer than soft dorsal, which is somewhat larger than the anal; the two dorsals connected by membrane; dorsal spines a little more than half the length of the head; pectorals large. Color olive, with a bright scarlet spot on each scale, these forming continuous lines along the rows of scales; 3 dark blotches across the back; one in front of dorsal, forming a black spot on the anterior spines; one between the two dorsal fins, forming a similar black spot on the last rays of the spinous dorsal; and one on the caudal peduncle, behind the second dorsal; sides with about 6 irregular dark-olive blotches just below the lateral line; edge of spinous dorsal black, below this bright orange-red, a dusky bar at the base; entire anal fin, cheeks, opercles, and a bar below the eye bright blue; females without red spots, the sides blotched. Head $4\frac{3}{4}$; depth $4\frac{3}{4}$. D. XI-12; A. II, 8; scales 5–46–5. L. $2\frac{1}{2}$ inches. Oconee River, Georgia; one of the most beautiful of the group.

(*Nothonotus inscriptus* Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 34, 1878.)

265.—ETHEOSTOMA Rafinesque.

(*Catonotus* Agassiz.)

(Rafinesque, Journ. de Physique, 1819, 419: type *Etheostoma flabellaris* Raf.)

Body elongate, compressed. Mouth terminal, more or less oblique; upper jaw not protractile. Vomerine teeth present; teeth in the jaws strong, the outer series canine-like. Opercular spine well developed. Gill-membranes broadly united. Scales rather large. Lateral line incomplete; an enlarged, black humeral scale. First dorsal fin low, considerably lower than the second dorsal, of 7 to 9 subequal spines, which, in the males, end in little fleshy knobs; anal fin smaller than the second dorsal, with 2 spines, the first of which is always the larger. Vertebræ (*E. lineolatum*) 14 + 21; size small. Coloration dark. The species are extremely quick in their movements, and their coloration, although not gaudy, is very elegant.

(The word *Ethcostoma* is stated by Rafinesque to mean "*various mouths*," the species known to him—*i. e.*, *Percina caprodes*, *Diplesium blennioides*, and *Etheostoma flabellare*—

being so different in respect to the form of the mouth, that he conceived that they might belong to different subgenera. The etymology of the word is not evident.)

a. Head entirely naked; lateral line short; lower jaw prominent.
b. Body with longitudinal dark stripes.

803. E. lineolatum (Ag.) Jor.—*Striped Darter.*

Body elongate, compressed, the back scarcely arched. Head long and rather pointed, entirely destitute of scales. Mouth rather large, terminal, oblique, the lower jaw the longer. Eye moderate, longer than the snout, about 4 in head. Opercular spine strong. Fins all low, the first dorsal in the males about half as high as the second; higher in the females; caudal large, rounded. Anal spines longer in females than in the males; dorsal and anal spines pointed in the female, in the male with thickened fleshy tips. Scales moderate. Lateral line extending about to end of first dorsal. Neck and throat naked; scales on sides extending up to the base of the dorsal fin. Color dark; each scale with a dark spot, these forming a series of conspicuous longitudinal lines along the rows of scales; second dorsal and caudal conspicuously cross-barred; head blackish, with dark stripes radiating from eye; males further marked with conspicuous dark cross bars. Head 4; depth 5. D. VIII–12; A. II, 8; scales 7–53–7. L. 2½ inches. Minnesota to Indiana; abounding in clear or rocky streams; one of the most singular and handsome of the darters.

(*Catonotus lineolatus* Agassiz, Amer. Journ. Sci. Arts. 1854, 305: *Catonotus lineolatus* Vaillant, l. c. 118.)

bb. Body not striped.

804. E. flabellare Raf.

Very similar to the preceding, but rather more elongate and less compressed. Head rather larger. A narrow strip along base of spinous dorsal not scaled. Coloration paler, there being little or no trace of the longitudinal stripes, so conspicuous in *E. lineolatum;* the males with cross blotches, the females nearly plain olivaceous; second dorsal and caudal fins barred; black humeral spot conspicuous. Lateral line usually very little developed; lower jaw less projecting than in *E. lineolatum.* Head 4; depth 5. D. VIII–12; A. II, 8; Lat. l. 46. Length 2½ inches. Western New York to Ohio Valley and North Carolina; very abundant in the tributaries of Lake Ontario.

(Rafinesque, Journ. de Phys. etc. Paris, 1819, 419: *Catonotus flabellatus* Vaillant, Recherches, 1873, 121: *Catonotus fasciatus* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 67: *Oligocephalus humeralis* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 66: *? Catonotus*

*kennicotti** Putnam, Bull. Mus. Comp. Zool. 1863, 3: *Etheostoma linsleyi* Storer, Proc. Soc. Nat. Hist. 1851, 37: *Catonotus flabellatus* Vaillant l. c. 121: *Catonotus linsleyi* Vaillant, Recherches, 1873, 125: *Etheostoma flabellare* Jordan, Man. Vert. ed. 2, 227.)

aa Cheeks, opercles, neck, and throat closely scaly; jaws equal; lateral line nearly complete.

805. E. squamiceps Jordan.

Body rather elongate, considerably compressed, the caudal peduncle deep. Head large; the jaws comparatively short and equal. Lateral line wanting only on a few of the posterior scales, and with occasional tubes behind the continuous series. Spinous dorsal low and short, the spines about equal, less than half the height of the second dorsal; bases of the two dorsals about equal, slightly connected by membrane. Color dark, without spots, stripes or bands, in spirits; male mottled, with about 6 cross-blotches; vertical fins cross-barred; lower fins black in the male, pale in the female; a large black humeral spot. Head $3\frac{1}{5}$; depth 5. D. IX–12; A. II, 7; scales 5–50–6. L. $2\frac{3}{4}$ inches. Ohio Valley; not common.

(Jordan, Bull. U. S. Nat. Mus. x, 11, 1877.)

266.—PŒCILICHTHYS Agassiz.

Rainbow Darters.

(*Oligocephalus*, *Boleichthys*, *Aplesion*, and *Alvarius* Girard: *Astatichthys* Vaillant: *Hololepis* Agassiz.)

(Agassiz, Amer. Journ. Sci. Arts, 1854, 304: type *Pœcilichthys variatus* Agassiz=*Etheostoma cærulea* Storer.)

Body variously robust or elongate, usually compressed. Head rather large. Mouth moderate, nearly horizontal, terminal or nearly so; vomer with teeth; premaxillaries not protractile. Gill-membranes scarcely connected. Scales rather large, those on the belly similar to the others. Lateral line wanting posteriorly, its tubes beginning at the orbit. Dorsal spines 6 to 11, the middle ones highest and more than half the height of the soft rays; second dorsal larger than spinous dorsal or anal; anal with two spines, the first usually the larger. Vertebræ in *P. cæruleus*, 15 + 18; in *P. eos*, 15 + 21. Size small. Coloration usually brilliant.

(ποικιλος, variegated; ἰχθὺς, fish.)

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* The original types of *Catonotus kennicotti*, now in poor condition, show the following characters:

Color plain, without trace of lines or spots; pectorals, caudal, and both dorsals checkered with black. Black humeral spot large. Cheeks, opercles and breast naked. Scales rather large. Lateral line extending to below middle of second dorsal. Gill-membranes forming an angle with each other. Pectorals a little shorter than head. Head $3\frac{3}{4}$; depth $5\frac{1}{2}$. D. VIII, 10; A. 11, 5; scales 5–40 6. From Southern Illinois.

a. Dorsal spines 8 or more; anal spines well developed.
b. Humeral region with an enlarged black scale-like process.
c. Cheeks and opercles naked; nape naked; body striped. ..... *virgatus.*
cc. Cheeks and nape naked; opercles scaly ..... *saxatilis.*
ccc. Cheeks, opercles, and nape more or less scaly ..... *punctulatus, artesiæ.*
bb. Humeral scale obsolete or wanting.
d. Opercles and cheeks naked; preopercle crenulate; anal spines very long. *lepidus.*
dd. Opercles scaly; preopercle strictly entire.
e. Lateral line nearly straight.
f. Cheeks naked; or with only 3 or 4 small imbedded scales close behind eye ..... *cæruleus, spectabilis.*
ff. Cheeks evidently scaly, at least above ..... *asprigenis, jessiæ.*
ee. Lateral line forming a slight curve above the pectorals; dorsals sub-equal. Dorsal spines 9 or 10. (*Boleichthys* Girard.)
g. Cheeks scaly ..... *butlerianus, barratti, fusiformis, erochrous, eos.*
gg. Cheeks naked ..... *exilis, warreni, gracilis.*
aa. Dorsal spines 6; anal spines obsolete? (*Alvarius*) ..... *lateralis.*

a. Dorsal spines 8 or more; anal spines well developed.
b. Humeral region with an enlarged scale-like process, which is always black.
c. Opercles, cheeks, and nape naked; body striped.

806. P. virgatus Jordan.

Body slender, subfusiform, compressed, the back somewhat elevated, the caudal peduncle rather deep. Head long, rather slender and pointed, little compressed, the snout but little decurved. Mouth rather large, somewhat oblique, the maxillary reaching to the pupil, the lower jaw scarcely shorter than the upper; teeth small, even, in several rows. Eye rather large. Posterior border of preopercle above, obtusely crenate. Scales rather large; lateral line distinct, on about 20 scales; 53 in a lengthwise series. Head naked; nape and breast naked. Color greenish, each scale with a small blackish spot, forming conspicuous lateral stripes, as in *Etheostoma lineolatum;* back and sides with cross-blotches; humeral scale large and black; dorsal and caudal fin faintly barred. Head $3\frac{2}{3}$; depth 5. D. IX–10; A. II, 8. Rock Castle River, Kentucky; resembles the species of *Etheostoma.*

(Jordan, Proc. U. S. Nat. Mus. ii, 236, 1879.)

cc. Cheeks and nape naked; opercles scaly.

807. P. saxatilis Hay.

Body rather slender. Head pointed, the profile descending in a gradual curve. Mouth large, the maxillary extending to opposite front of pupil. Eye equal to snout, 4 in head. Cheeks, breast, and throat naked; opercles with a few large scales. Lateral line little arched, its tubes on about 35 scales. Dorsals well separated, the second shorter and higher than first. Greenish, with darker tessellations; a black

humeral scale, a black streak downward and forward from eye; opercles mostly black. Head 4; depth 5. D. XI–10; A. II, 7; scales 11–50–5. L. 1½ inches. Chickasawha River, Mississippi. (*Hay.*)

(Hay, Proc. U. S. Nat. Mus. 1880, 495.)

ccc. Cheeks, opercles, and nape more or less scaly.

808. P. punctulatus Ag.

Body elongate, compressed, the back not elevated. Head slender, rather long and pointed, compressed. Mouth large, terminal, oblique, the jaws about equal, the maxillary extending nearly to opposite middle of eye. Scales quite small; a few imbedded scales on upper part of cheeks and behind eye; neck mostly covered with small scales; throat naked. Fins rather small, the pectorals short. Color, in life, not known; in spirits, the sides of the body clouded or reticulated with darker; a conspicuous black humeral spot; first dorsal dark at base, then pale, with a narrow dark border; the other vertical fins similarly colored, the dark colors probably blue in life; females with the sides and fins speckled. Head 4; depth 4¼. D. X–11; A. II, 7; scales 9–60–20. L. 2½ inches. Missouri to Texas.

(Agassiz, Amer. Journ. Sci. Arts, 1854, 304: *Boleichthys whipplei* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 101: *Nothonotus punctulatus* Agassiz, Bull. Mus. Comp. Zoöl. i, 3, 1863.)

809. P. artesiæ Hay.

Body elongate, compressed. Head large. Mouth large, terminal, nearly horizontal, the lower jaw slightly included; maxillary reaching to opposite front of pupil. Palatine teeth in a broad band. Eye equal to snout, 4½ in head. Cheeks entirely covered with small scales; opercles with large scales; scales along back very small. Lateral line extending to end of second dorsal, on about 45 scales. Dorsals contiguous; first dorsal as long as head, its height less than half its length; soft dorsal considerably higher; anal a little over half length of head; pectorals reaching tips of ventrals, much smaller than in *P. cæruleus*. Yellowish-olive, with transverse oblique bars of darker, and sprinkled with small blotches of carmine; pectorals and ventrals dull blue; dorsals with a broad band of carmine along their middle, bordered on each side by orange; tips of dorsals dull blue, as is the base of the soft dorsal; base of spinous dorsal with several carmine spots; anal mostly crimson, tipped with blue; caudal blue, then orange, carmine orange, and tipped with blue; a black humeral scale. Head 3¾; depth 5. D.

XI–13; A. II, 7; scales 8–56–11. L. $2\frac{3}{4}$ inches. Tombigbee River, Mississippi. (*Hay.*)

(Hay, Proc. U. S. Nat. Mus. 1880, 494.)

bb. Humeral scale obsolete.

d. Opercles and cheeks naked; preopercle crenulate; anal spines very long.

810. *P. lepidus (B. & G.) Grd.

Body rather stout, compressed, tapering backwards. Head subconical. Mouth moderate, with equal jaws; maxillary reaching front of orbit. Eyes large. First dorsal rather low; dorsal fins somewhat connected. Head, as well as throat and neck, entirely scaleless. Color olivaceous, with some dark (blue?) bars; scales dusky at base; dorsals and caudal mottled or barred. Head $4\frac{1}{4}$; depth $4\frac{2}{3}$. D. IX–11; A. II, 6; scales in about 50 series. L. $2\frac{1}{2}$ inches. Texas.

(*Boleosoma lepida* B. & G. Proc. Acad. Nat. Sci. Phila. 388, 1853; Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 11: *Oligocephalus lepidus* Grd. Proc. Acad. Nat. Sci. Phila. 1859, 67: *Boleosoma lepidum* Günther, i, 77.)

dd. Opercles scaly; preopercle strictly entire; anal spines moderate.

e. Lateral line nearly straight.

f. Cheeks naked, or with only 3 or 4 small imbedded scales close behind eye.

811. P. cæruleus (Storer) Agassiz.—*Blue Darter; Rainbow Darter; Soldier-fish.*

Body robust, rather deep and compressed, the back somewhat elevated. Head large, compressed. Mouth moderate, terminal, oblique, the lower jaw somewhat included, the maxillary reaching front of orbit. Palatine teeth in one row. Neck and breast usually naked. Fins all large; dorsal fins usually slightly connected. Males olivaceous, tessellated above, the spots running together into blotches; back without black lengthwise stripes; sides with about 12 indigo-blue bars running obliquely downwards and backwards, most distinct behind, separated by bright orange interspaces; caudal fin deep orange, edged with bright blue; anal fin orange, with deep blue in front and behind; soft dorsal chiefly orange, blue at base and tip; spinous dorsal crimson at base, then orange, with blue edgings; ventrals deep indigo; cheeks blue; throat and breast orange; females much duller, with little blue or red, the vertical fins barred or checked; young variously marked. Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. D. X–12; A. II, 7; scales 5–45–8, the lateral line developed on about 30–35 scales. L. $2\frac{1}{2}$ inches. Mississippi Valley; very

* Four more nominal species of this type are described by Girard (Proc. Acad. Nat. Sci. Phila. 1859, 102) under the names *Aplesion potsii*, *Oligocephalus grahami*, *O. leonensis*, and *O. pulchellus;* the first from Chihuahua, the next two from Texas, the latter from Canadian River. *A. potsii* has D. X–I, 11; *O. grahami* has D. IX–13; A. II, 8; *O. leonensis* D. IX–10; A. II, 7; *O. pulchellus* A. II, 6. All are probably identical with *P. lepidus.*

abundant in river channels. One of the most gorgeously-colored darters, but less graceful than most of them.

(*Ethcostoma cærulea* Storer, Proc. Bost. Soc. Nat. Hist. 1845, 47: *Pœcilichthys cæruleus* Agassiz, Bull. Mus. Comp. Zoöl. i, 3, 1863: *Pœcilichthys variatus* Jordan, Man. Vert. ed. 2, 226: *Astatichthys pulchellus* Vaillant, l. c. 113.)

812. P. spectabilis Agassiz.

Very similar to the preceding, but more elongate and rather more compressed; the colors similar, but the upper portion of the sides with distinct blackish stripes along the rows of the scales, and the ground color of the back and sides having a peculiar whitish or bleached appearance. The two dorsal fins usually well separated. Scales usually present below and behind eye. Head 4; depth 4½. D. X–12; A. II, 7; scales 5–40–7; Lat. l. on 20–25 scales. L. 2–3 inches. Mississippi Valley; rather less abundant than the other, and ascending small or even muddy streams. Probably merely a brook variety of the preceding, from which it is not always to be distinguished with certainty.

(Agassiz, Amer. Journ. Sci. Arts, 1854, 304; Jordan, Man. Vert. ed. 2, 227.)

ee. Cheeks evidently scaly, at least above.

813. P. asprigenis Forbes.

Body rather stout, compressed. Head small and pointed. Eye large, longer than snout. Mouth terminal, oblique, the jaws even. Breast always naked; opercles scaly; cheeks closely scaled, the lower fourth rarely bare. Dorsal fins usually separated. Coloration mottled greenish; the spinous dorsal dusky behind, in life with a broad band of blue and crimson; soft fins speckled. Head 4; depth 4½. D. XI–12; A. II, 8; Lat. l. 49, the tubes developed on 34–41 scales. L. 2½ inches. Illinois River.

(Forbes, Bull. Ill. Lab. Nat. Hist. i, 41, 1877; Jordan, Man. Vert. ed. 2, 404.)

814. P. jessiæ Jordan & Brayton.

Body fusiform, rather deep and compressed. Head rather large, moderately pointed. Mouth rather large, terminal, the upper jaw slightly longest. Cheeks scaly above, the greater part naked; opercles scaly; throat naked; neck above scaly. Lateral line extending nearly to end of second dorsal. Fins moderate. Chestnut colored above, with about 9 quadrate bar-like blotches of a dark-blue color along the sides, and about 5 dark cross-blotches on the back; fins mottled with chestnut; a yellow or orange band across the dorsal; second dorsal and anal speckled with golden. Head 4; depth 5. D. XII–12; A. II, 9; scales

6–47–7, the tubes of the lateral line on about 35 scales. L. 3 inches. Chickamauga River, Georgia.

(Jordan, Man. Vert. ed. 2, 1878, 227; Jordan & Brayton, Bull. U. S. Nat. Mus. xii, 59, 1878.)

ee. Lateral line forming a slight curve above the pectorals; dorsals subequal; dorsal spines 9 or 10. (*Boleichthys** Grd.)

g. Cheeks scaly.

815. P. butleriamus Hay, (sp. nov.).

Body elongated, contracted behind ventral fins; dorsal region elevated. Mouth horizontal, small; maxillary extending to opposite anterior edge of pupil. Opercles with 2 rows of scales along lower edge; cheeks densely scaled; lateral line running high, extending to opposite end of anterior dorsal, on 18 scales. Pale greenish, yellow below; above and on sides much mottled with brown; about 10 square blotches along back; a dark spot on opercle, one behind and one below eye; a streak on snout between eyes; dorsals with dark markings; a red streak along margin of spinous dorsal; anal fin nearly white; caudal barred. Head 4 in length; depth $5\frac{5}{6}$. Eye $3\frac{1}{2}$ in head. Caudal peduncle $3\frac{3}{4}$ in body. D. IX–11; A. II, 6; scales 3–44–12. Black River, Mississippi. (*Hay* MSS.)

816. P. barratti (Holbr.) J. & G.

Body comparatively short, chubby and compressed. Head rather large. Mouth large, oblique; the jaws equal, the teeth rather strong. Eye large, 3 in head. Scales large, varying in number. Lateral line beginning at the eye, arched high over the pectorals and ceasing about midway of the body, developed on about 20 scales. Opercular spine strong. Dorsal fins moderate, about equal, separated by an interspace. Color greenish, with dark specks; fins mottled; a dark line downward and one forward from eye; a series of rather small greenish blotches along each side and on the back. Head $3\frac{3}{4}$; depth $4\frac{3}{4}$. D. X–12; A. II, 7; lateral line 45–55. L. 2 inches. Maryland to Illinois and southward; chiefly in streams of the lowlands.

(*Boleosoma barratti* Holbr. Journ. Acad. Nat. Sci. Phila. 1855, 56: *Hololepis barratti* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 233: *Hololepis barratti* Vaillant, l. c. 127: *Boleichthys elegans* Jordan, Amer. Lyc. Nat. Hist. N. Y. 1876, 308: *Boleichthys elegans* Jordan, Man. Vert. 404, and probably of Girard, Proc. Acad. Nat. Sci. Phila. 1859, 104.)

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* *Boleichthys* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 103: type *Boleichthys exilis* Grd. (βολις, dart; ἰχθῦς, fish.)

817. P. fusiformis (Grd.) J. & G.

Body moderately elongate, strongly compressed. Head rather long and narrow; muzzle short, decurved, shorter than the eye. Mouth comparatively large, terminal; maxillary reaching past front of eye. Eyes large, 4 in head. Opercular spine strong. Lateral line beginning at the eye, on about 12 to 15 scales. Neck scaly; belly and throat scaly. Olivaceous, dotted with dusky points; second dorsal and anal speckled. Head 4; depth 6. D. X–9; A. II, 7; Lat. l. 55. L. 2 inches. Massachusetts to New Jersey.

(*Boleosoma fusiformis* Girard, Proc. Bost. Soc. Nat. Hist. v, 1854, 41: *Hololepis fusiformis* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 233: *Hololepis fusiformis* Vaillant, l. c. 131: *Boleichthys fusiformis* Jordan, Man. Vert. 228.)

818. P. erochrous (Cope) J. & G.

Body elongate, compressed; the dorsal outline curved, the ventral nearly straight. Head long, decurved and narrowed in front. Mouth subinferior; the maxillary reaching past front of eye. Eye 4 in head, greater than length of snout. Opercular spine strong. Lateral line developed on about 16 scales. General color rather dark; blackish above; a black streak on muzzle and one downward from eye; a dark band, irregularly notched, along the sides, besides dark specks; caudal barred; the sides along the lateral band marked by red dots in life. Head 4; depth 6. D. IX–10; A. II, 7; Lat. l. 43. L. 2 inches. Streams tributary to Delaware and Chesapeake Bays. (*Vaillant.*)

(*Hololepis erochrous* Cope, Proc. Acad. Nat. Sci. Phila. 1864, 233: *Hololepis erochrous* Vaillant, l. c. 133: *Boleichthys erochrous* Jordan, Man. Vert. 228.)

819. P. eos Jordan & Copeland.

Body elongate, slender, somewhat compressed, especially behind, rather heavy forwards, with very long and slender caudal peduncle. Head long, rounded in front. Mouth small, little oblique, the upper jaw a very little the longer. Dorsal fins high, about equal; caudal truncate. Cheeks, opercles, and neck closely scaled. Breast naked, or with a median series of small scales. Lateral line developed on 22 to 26 scales. Color dark olive, with darker markings; 10 or 12 dark dorsal spots or bars, and as many short dark-blue bars across the lateral line nearly opposite the dorsal bars, but not continuous with them; the interspaces between these bars, as well as most of the ventral region, bright crimson in the males, nearly plain in the females; lower parts of the sides, cheeks, etc., with various sharply defined but irregular black markings; second dorsal, caudal, and pectorals strongly marked with

wavy bands; first dorsal bright blue in the males, with a broad median band of crimson; speckled in the females; top of head dark; black streaks downward and forward from eye. Head 4; depth 5⅓. D. IX–11; A. II, 7; Lat. l. 58. L. 2½ inches. Indiana to Minnesota; abundant in clear cold streams; one of the prettiest of the darters.

(*Boleichthys eos* Jordan & Copeland, Proc. Acad. Nat. Sci. Phila. 1877, 46: *Boleichthys eos* Jordan, Man. Vert. 228.)

gg. Cheeks naked; opercles scaly.

820. P. exilis (Grd.) J. & G.

Body compressed, tapering towards the caudal peduncle, which is slightly contracted. Eye large, subcircular, 3½ in head; maxillary reaching anterior edge of pupil. Lateral line nearer the dorsal than the abdominal outline; pectorals extending further than the ventrals. Yellowish-brown, speckled with grayish-black, dorsals and caudal barred; a dark spot on the occipital region and a streak in advance of as well as beneath the orbit. Head 4¼ (with caudal). D. X–10; A. II, 8. L. 1¾ inches. Little Muddy River, a tributary of the Upper Missouri. (*Girard.*) Differs from *P. eos* in the naked cheeks.

(*Boleichthys exilis* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 103.)

821. P. warreni (Grd.) J. & G.

"Resembles *P. exilis* more than any of its congeners by the shape of the body and the general appearance. It differs by a more compact body, a proportionally shorter head, smaller scales, and the number of fin rays. Ground color yellowish-brown, the middle of the flanks maculated with transverse spots of blackish; the belly exhibiting a rather orange hue; the first dorsal has a series of vertically elongated black spots resembling a dark band across the middle of the fin; the second dorsal and caudal are transversely multilineated. A black streak may be seen in advance of the orbit and another beneath it." D. IX–11; A. II, 9. L. 2 inches. Cannon Ball River. (*Girard.*) Perhaps identical with the preceding.

(*Boleichthys warreni* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 104.)

822. P. gracilis (Grd.) J. & G.

Slender and graceful; first dorsal lower and longer than the second; anal much deeper than long; tips of the ventral fins extending a little further back than those of the pectorals. Olivaceous, spotted with blackish; second dorsal and caudal barred; a longitudinal black streak in advance of the orbits and a vertical one beneath them. Head 4½

(with caudal). D. X, 10; A. 8. L. $1\frac{3}{4}$ inches. Rio Seco and Rio Leona, Texas. (*Girard.*) The types of this species, examined by us, have the lateral line incomplete and the premaxillaries not protractile.

(*Boleosoma gracile* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 103.)

** Dorsal spines 6; anal spines obsolete? (*Alvarius** Girard.)

823. P. lateralis (Grd.) J. & G.

"A representative of the Etheostomoid family was procured by the United States and Mexican Boundary Commission at the Rio Grande del Norte (Rio Bravo). It constitutes a new generic type allied to *Catonotus*, and to which we have applied the name of *Alvarius*, with the following characters. Head elongated and tapering. Mouth terminal, large, not protractile; lower jaw longer than the upper. Teeth very minute. Opercular apparatus, cheeks, and throat scaly. First dorsal nearly equal in height to the second, from which it is quite distinct. Anal fin much smaller than the second dorsal; caudal fin truncated; five soft rays to the ventrals. Ventral scales uniform." Body slender, elongate. Head subconical and tapering forward. Eye equal to snout, 4 in head. Maxillary reaching pupil. First dorsal about equal to second and separated from it. Anal smaller than second dorsal, the last rays of the two fins opposite each other. Scales very small. Lateral line median. Brownish, back spotted; sides with a narrow blackish streak, which extends around the snout; first dorsal with a black spot on its upper posterior edge; caudal transversely barred. D. VI, 10; A. 8. L. $1\frac{3}{4}$ inches. Rio Grande. (*Girard.*)

(*Alvarius lateralis* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 101.)

267.—MICROPERCA Putnam.

(Putnam, Bull. Mus. Comp. Zoöl. I, 1863, 4: type *Microperca punctulata* Putn.)

Body rather short, compressed. Mouth moderate, the jaws about equal. Premaxillaries not protractile. Vomerine teeth present. Gill-membranes scarcely connected. Scales large. Lateral line obsolete. Dorsal fins small, subequal, well separated, the first with six or seven spines; anal fin much smaller than second dorsal, with two well-developed spines. Color greenish, with dusky markings. Size very small, probably the smallest of the spiny-rayed fishes. (μικρος, small; περκη, perch.)

824. M. prœliaris Hay.

Body short and stout. Snout conical, pointed; jaws equal; mouth

*Alvarius Girard, Proc. Acad. Nat. Sci. Phila. 1859, 101: type *Alvarius lateralis*. (A coined name without meaning.)

small, slightly oblique, maxillary reaching front of eye. Eye small, 4 in head. Cheeks and opercles with large scales. Opercular spine well developed. Scales large, the tubes of the lateral line developed on two of them; dorsals well separated. Anal spines slender, high; pectorals and ventrals reaching about to vent. Olive, speckled with brown; ten brownish spots along the sides; black streaks downward and forward from eye; dorsal fins mottled. Head 4; depth $4\frac{1}{5}$. D. VIII, 11; A. II, 6. Lat. l. 36. L. $1\frac{1}{2}$ inches. Alabama and Mississippi.

(Hay, Proc. U. S. Nat. Mus. 1880, 496.)

825. M. punctulata Putnam.—*Least Darter.*

Body rather short and deep, somewhat compressed, the back arched. Caudal peduncle rather long. Head moderate. The snout somewhat decurved. The mouth moderate, terminal, oblique. Cheeks naked. Opercles somewhat scaly. Opercular spine very small. Neck and chest naked. No trace of lateral line. The usual series of tubes along the temporal region. Scales quite large, strongly ctenoid. Vertical fins short. Anal spines strong, the first usually the largest. Coloration olivaceous, the sides closely speckled and with vague bars and zigzag markings; second dorsal and caudal barred; dark streaks radiating from eye; a dark humeral spot. Head $3\frac{3}{4}$; depth $4\frac{1}{2}$. D. VI–VII, 10; A. II, 6; Lat. l. 34. L. $1\frac{1}{2}$ inches. Smallest of the darters, and one of the smallest of fishes, abounding in the clear streams of the Northwestern States.

(Putnam, Bull. Mus. Comp. Zoöl. i, 1863, 4; Jordan, Man. Vert. 229.)

268.—PERCA Linnæus.

Perch.

(Artedi: Linnæus, Systema Naturæ: type *Perca fluviatilis* L.)

Body oblong, somewhat compressed, the back elevated. Cheeks scaly; opercles mostly naked; the operculum armed with a single spine. Preopercle and shoulder girdle serrated. Mouth moderate, terminal; premaxillaries protractile; teeth in villiform bands on jaws, vomer, and palatines; no canine teeth. Branchiostegals 7. Gill-membranes separate; pseudobranchiæ small, but perfect; no anal papilla. Scales rather small, strongly ctenoid. Lateral line complete. Dorsal fins entirely separate, the first of 12–15 spines; anal fin with two slender spines; caudal emarginate; air-bladder present. Pyloric cœca 3; vertebræ (*P. fluviatilis*) 21+20. Fresh waters of northern regions; three species now known: *P. fluviatilis* in Europe, *P. schrencki* in Asia, and *P. americana.* This genus has long been considered the type of the

spiny-rayed fishes, and in many systems it has been placed first in the series of fishes. (πέρκη, *Perca*, the ancient name of *P. fluviatilis*, from πέρκος, dusky.)

826. P. americana Schranck.—*Yellow Perch; American Perch; Ringed Perch.*

Back dark olivaceous; sides golden yellow; belly pale; sides with 6 or 8 broad dark bars, which extend from the back to below the axis of the body; lower fins largely red or orange; upper fins olivaceous; usually no distinct black spot on anterior or posterior part of spinous dorsal. Back highest at origin of spinous dorsal, which is more or less behind insertion of pectoral; profile convex from dorsal to occiput, thence concave anteriorly, the snout projecting. Mouth somewhat oblique, maxillary reaching opposite middle of orbit. Cheeks closely scaled throughout, the scales imbricated; opercular striæ and rugosities on top of head well marked. Pseudobranchiæ quite small. Gill-rakers stout, shortish. Head $3\frac{1}{4}$ in length; depth $3\frac{1}{4}$. D. XIII–I, 14; A. II, 7; scales 5–55–17. Fresh waters of the Eastern United States; chiefly northward and eastward; abundant.

This species has been recently considered as a slight variety of the European *Perca fluviatilis*. It is, however, distinguished by the following characters: The head in *P. americana* is rougher, the opercle more strongly striate, the bones generally with finer and more numerous serræ; the preorbital is serrate, the scales on the cheeks are larger, imbricated and distinctly ctenoid; the maxillary extends to opposite the middle of the pupil. The gill-rakers are stout, the longest but three times as high as broad. The pseudobranchiæ are much smaller than in *P. fluviatilis*. First spine of the dorsal over or behind the posterior edge of the opercle, a series of scales downward from it reaching about to base of pectoral. In *P. fluviatilis* the dorsal is further forward, and the anterior spines are considerably higher than in *P. americana*. The scales are usually larger in the American species, the dark bars are more sharply defined, and the black spot on the membrane of the last dorsal spines, well defined in *P. fluviatilis*, is usually wanting. The most important characters, the difference in the insertion of the dorsal, and in the gill-rakers and pseudobranchiæ, have not been noticed by those writers who have decided that our species is identical with the European.

(*Perca americana* Schranck, about 1790, fide Gill: *Bodianus flavescens* Mitch. Trans. Lit. & Phil.Soc. N. Y. 1815, 421: *Perca flavescens* Holbrook, Ichth. S. C. 1860, 2: *Perca flavescens*, *acuta*, and *gracilis* Günther, i, 59–60: *Perca fluviatilis* var. Steindachner, Sitzungsber. Wiener Akad. 1878.)

269.—STIZOSTEDIUM Rafinesque.

Pike Perches.

(*Lucioperca* Cuvier: *Centropomus* Bleeker.)

(*Stizostedion* Rafinesque, Ichth. Oh. 1820, 23: type *Perca salmonea* Raf.)

Body slender, elongate, fusiform. Head subconical, long. Cheeks and opercles more or less scaly; top of the head with some scales. Mouth large, the jaws about equal; premaxillaries protractile, little movable. Teeth in villiform bands, the jaws and palatines with long, sharp canines. Gill-rakers slender, strong; gill-membranes separate. Preopercle serrated; opercle with one or more spines, terminations of radiating striæ. Dorsal fins separate, the first with 12 to 15 spines; anal spines 2, slender; ventral fins not close together. Scales small, strongly ctenoid; lateral line continuous. Pseudobranchiæ well developed. Pyloric cœca 3 to 7. Large carnivorous fishes of the fresh waters of North America and Europe; two strongly marked species on each continent. (στιζω, to prick; δτεθιον, a little breast; "the name means pungent throat," according to Rafinesque.)

a. Pyloric cœca 3, subequal, all about as long as the stomach. (*Stizostedium.*)

827. S. vitreum (Mitch.) Jordan & Copeland.—*Wall-eyed Pike; Dory; Glass-eye; Yellow Pike; Blue Pike; Jack Salmon.*

Dark olive, finely mottled with brassy, the latter color forming indistinct oblique lines; sides of head more or less vermiculated; lower jaw flesh-colored; belly and lower fins pinkish; spinous dorsal with a large jet-black blotch on the membrane of the last two or three spines, otherwise nearly plain; second dorsal and caudal mottled olive and yellowish; base of pectorals dusky without distinct black blotch. Body slender, becoming compressed with age, the back more arched than in *S. canadense*. Dorsal spines high, more than half length of head; soft dorsal nearly as long as spinous dorsal. Head $3\frac{2}{3}$; depth about $4\frac{1}{2}$. Eye shorter than snout, $4\frac{1}{2}$–5 in head. D. XIII–I, 21; A. II, 12; Lat. l. 90. Pyloric cœca 3, rather long. Great Lake region, Upper Mississippi, and some Atlantic streams, north to the fur countries; an abundant and valued food-fish, reaching a length of nearly 3 feet and a weight of 10 to 20 pounds.

(*Perca vitrea* Mitch. Sup. Amer. Month. Mag. ii, 247, 1818: *Lucioperca americana* Cuv. & Val. ii, 122; *Lucioperca americana* Günther, i, 74; Jordan, Bull. U. S. Nat. Mus. x, 46: *Perca salmonea* Raf. Amer. Month. Mag. v, 354, 1818: *Stizostedium salmoneum*

Jordan, Bull. U. S. Nat. Mus. x, 47: *Stizostethium vitreum* var. *salmoneum* Jordan, Man. Vert. ii, 230, the "Blue Pike," a local variety in Ohio and southward; bluer, with the body shorter and deeper, the size smaller.)

aa. Pyloric cœca small, unequal, 4 to 7 in number. (*Cynoperca* Gill & Jordan.*)

828. S. canadense† (Smith) Jor.—*Sauger; Sand-pike; Gray-pike; Horn-fish.*

Olive gray above, sides brassy or pale orange, with much dark mottling; young pale orange with large dark lateral shades; spinous dorsal with 2 or 3 rows of round black spots; no distinct black blotch on the posterior part of the fin; a large black blotch at base of pectorals; second dorsal with about 3 rows of irregular dark spots; caudal dusky and yellowish. Body elongate, more terete than in the preceding. Head quite pointed, depressed, about $3\frac{1}{2}$ in length; depth $4\frac{1}{2}$–5. Eye small, 5 in head. Opercular spines varying in number and size. D. XIII-I, 18; A. II, 12; Lat. l. 95. Pyloric cœca 4–7, smaller than in *S. vitreum*. L. 15 inches. Great Lake region, Upper Mississippi and Ohio Rivers.

(*Lucioperca canadensis* C. H. Smith, MSS. in Griffith's edition Cuvier's Animal Kingdom, x, 275, 1836: *Lucioperca canadensis* Günther, i, 75: *Lucioperca grisea* DeKay, N. Y. Fauna, Fishes, 1842, 19; *Lucioperca grisea* Günther, i, 76; Jordan, Bull. U. S. Nat. Mus. x, 48: *Lucioperca borea* Grd., Proc. Acad. Nat. Sci. Phila. 1857.)

Family LXXXVI.—SERRANIDÆ.

(*The Sea Bass.*)

Body oblong or elongate, more or less compressed, covered with adherent, ctenoid (rarely smooth) scales of moderate or small size. Mouth horizontal or little oblique, usually large. Premaxillary protractile. Maxillary broad, with or without a supplemental bone, its posterior part not slipping under the edge of the preorbital. Jaws with bands of teeth, some of the teeth sometimes enlarged and canine-like; no incisors nor molar teeth; vomer and palatines with bands of villiform teeth; tongue sometimes with teeth; pterygoids toothless. Gill-rakers usually stiff and rather long, armed with teeth. Gills 4, a long slit behind the fourth. Pseudobranchiæ large. Lower pharyngeals separate, rather narrow,

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*Jordan, Bull. U. S. Nat. Mus. x, 48: type *Lucioperca canadensis* Smith. κυον, dog; περκη, perch.

†Three varieties of this species may usually be recognized:

a. Var. *canadense*, of the St. Lawrence region, with the opercles and bones of the head considerably rougher, the number of opercular spines, which are merely the free ends of the striæ, increased; the head is also more closely and extensively scaly;

b. Var. *griseum* (DeKay), the common form of the Great Lake region, described above; and

c. Var. *borcum* Grd. from the Upper Missouri region, with the head slenderer.

These forms intergrade and are doubtless varieties of the same species.

with pointed teeth. Gill-membranes separate, free from the isthmus. Branchiostegals 7 or 6. Cheeks and opercles scaly; preopercle with its posterior margin usually more or less serrate; opercles usually ending in one or two flat points or spins. Nostrils double. Lateral line continuous, single, not running up on the caudal fin (except in *Centropomus*). Skull without cranial spines, not cavernous. No suborbital stay. Dorsal fin variously developed, continuous or divided, the spines generally stiff. Anal fin rather short, with 3 spines, which are rarely reduced in number or obsolete. Ventrals separate, thoracic, I, 5. Pectorals well developed. Caudal fin truncate, rounded, or moderately forked, its peduncle stout and not keeled. Vertebræ about 25. Air-bladder present, usually rather small, and adherent to the walls of the abdomen. Intestinal canal short, with several or many pyloric appendages; the stomach cœcal.

Genera 40; species about 300. Carnivorous fishes, chiefly marine, and found in all warm seas; a few in fresh waters.

As here understood, the *Serranidæ* comprises the most of the family of *Percidæ* as understood by Günther and others, exclusive of those with imperfect pseudobranchiæ, those with one or two anal spines and with the number of vertebræ increased, those in which the whole length of the maxillary slips under the preorbital, and the forms related to *Priacanthus*. Even after these eliminations the family is considerably varied. The definition of genera in this group offers many difficulties.

(*Percidæ*, groups *Percina*, *Serranina*, exclusive of certain species, Günther, i, 61–220: *Serranidæ*, *Labracidæ*, *Centropomidæ*, Gill.)

*Anal spines strong; dorsal spines several.

†Branchiostegals seven.

a. Teeth all villiform, without canines.

b. Caudal fin deeply forked; dorsal divided.

c. Tongue toothless; supplemental maxillary present. (*Centropominæ.*)

d. Second anal spine strong ..... CENTROPOMUS, 270.

cc. Tongue with teeth; supplemental maxillary wanting. (*Labracinæ.*)

e. First dorsal with 9 spines ..... ROCCUS, 271.

bb. Caudal fin not forked.

e. Tongue toothless; head scarcely armed.

f. First dorsal of 10 spines, depressible in a groove .. STEREOLEPIS, 272.

ee. Tongue with teeth; head well armed.

g. Dorsal continuous; a rough ridge on the operculum.

POLYPRION, 273.

aa. Teeth not all villiform, some of them more or less enlarged and canine like. (*Serraninæ.*)

h. Maxillary without distinct supplemental bone; lateral canines usually stronger than those in front ..... SERRANUS, 274.

hh. Maxillary with a distinct supplemental bone; anterior canines strongest; inner series of teeth depressible.

i. Cranium above with three parallel raised crests; anal rays about III, 11 ..... TRISOTROPIS, 275.

i. Cranium with only the median crest developed; anal rays about III, 9 ..... EPINEPHELUS, 276.

hhh. Maxillary unknown; "pyloric cœca innumerable." PROMICROPS, 277.

†† Branchiostegals 6; dorsal spines 10, the third filamentous..... DULES, 278.

** Anal spines obsolete or reduced to 2; scales very small, smooth. (*Rhypticinæ*.)

j. Dorsal spines 2 or 3 only ..... RHYPTICUS, 279.

270.—CENTROPOMUS Lacépède.

(*Oxylabrax* Bleeker.)

(Lacépède, Hist. Nat. Poiss. iv, 248, 1802: type *Sciæna undecimalis* Bloch.)

Body elongate, covered with rather small, ctenoid scales. Head oblong-conical, depressed, lower jaw projecting; teeth on jaws, vomer, and palatines, all villiform, without canines; tongue smooth. Maxillary with a strong supplemental bone. Preopercle serrated; two stronger spines at its angle; opercle without true spines; preorbital and supra-scapular usually serrated. Dorsal fins entirely separated; the first with 8 spines; the first and second spines usually much shorter than the third. Anal fin short, with 3 spines, the second of which is long and strong. Caudal forked. Lateral line conspicuous, extending on the caudal fin. Branchiostegals 7. Species numerous, inhabiting tropical seas. According to Professor Gill the skeleton of *Centropomus* differs so widely from that of the other *Serranoids* that it should constitute a separate family. (κεντρον, spine; πῶμα, operculum.)

a. Lat. l. about 70; body elongate.

879. C. undecimalis (Bloch.) Cuv. & Val.—*Robalo.*

Silvery, greenish above; lateral line black, very distinct; dorsal and caudal dusky; other fins yellowish; ventrals without dusky area. Preorbital nearly entire. Third dorsal spine longer than the fourth; second anal spine comparatively short, about as long as third. Air-bladder anteriorly with two long, slender, backward-directed horns. Head 3; depth 4½. D. VII–I, 9; A. III, 6; Lat. l. 70. A large food-fish, abundant in the West Indies; ranging northward to Lower California, Florida, and Texas.

(*Sciæna undecimalis* Bloch. Ichth. 303; Günther, i, 79; Vaillant & Bocourt, Miss. Sci. au Mex. iv, 17: *Centropomus viridis* Lockington, Proc. Cal. Acad. Nat. Sci. 1877, 16.)

271.—ROCCUS Mitchill.

Bass.

(*Labrax* Cuvier, 1817; preoccupied in *Chiridæ*.)

(Mitchill, Rept. part, Fish. N. Y. 1814, 25: type *Roccus striatus* Mitch. = *Sciæna lineata* Bloch.)

Body oblong or ovate, compressed and more or less elevated. Head

conical, scaly above and on sides. Mouth rather large, nearly horizontal; the jaws equal, or the lower projecting. Premaxillaries protractile; maxillaries large, without supplemental bone, only the edge of the anterior part slipping under the preorbital. Teeth all villiform, in bands, on jaws, vomer, palatines, and tongue. Eye large, orbital ridge a little elevated. Preopercle serrate behind and below; the teeth of its lower margin sometimes enlarged. Opercle with two flat spines. Preorbital narrow. Pseudobranchiæ large. Scales large. Breast scaly. Dorsal fins separate or connected at base, the anterior with 9 strong spines. Anal spines well developed. Caudal fin lunate. Pectorals small. Species about 6, in America and Europe, inhabiting both fresh and salt waters. (Name derived from the vernacular "Rock-fish.")

a. Serræ on lower edge of preopercle small, not directed forwards.

b. Teeth on base of tongue; anal spines graduated; lower jaw projecting; scales on cheeks almost cycloid; dorsal fins separate.

c. Teeth on base of tongue in two patches; body elongate, little compressed. (*Roccus* Mitchill.)

830. R. lineatus (Bloch) Gill.—*Striped Bass; Rock-fish; Rock.*

Olivaceous-silvery; sides and below silvery white or brassy; sides marked with 7 or 8 longitudinal dark bands, one of which runs along the lateral line; the stripes usually continuous. Body elongate, little elevated; the young slender; axis of body about in the middle of the depth of the body. Mouth large, oblique; the large maxillary reaching to below the middle of orbit. Eye about half length of snout. Pectoral short, $1\frac{3}{4}$ in head. Spines slenderer than in the other species; the second anal spine $\frac{1}{5}$ length of head. Head $3\frac{1}{2}$ in length; depth $3\frac{1}{2}$. D. IX–I, 12; A. III, 11; Lat. l. 65. L. 3–4 feet. Atlantic coast; entering rivers; one of the largest and finest of our game fishes.

(*Sciæna lineata* Bloch. Ichth. ix, 53: *Roccus lineatus* Gill. Proc. Acad. Nat. Sci. Phila. 1860, 64: *Labrax lineatus* Holbrook, Ich. S. C. 1860, 24: *Labrax lineatus* Günther, i, 64.)

cc. Teeth on base of tongue in a single patch; body oblong, compressed. (*Lepibema** Raf.)

831. R. chrysops (Raf.) Gill.—*White Bass.*

Silvery, tinged with golden below the lateral line and with reddish above; sides with blackish or dusky longitudinal lines, 4 or 5 above the lateral line, one through which the lateral line runs, and a variable number of more or less distinct ones below it, the latter sometimes more or less interrupted or transposed. Dorsal outline much curved;

*Rafinesque, Ich. Oh. 1820, 23: type *Perca chrysops*. (λεπις, scale; βημα, stair; from "the scaly bases of the fins.")

second anal spine $\frac{1}{3}$ length of head. Axis of body rather below the middle of its depth. Head conical, slightly depressed at the nape. Mouth small, nearly horizontal; maxillary reaching middle of pupil. Head about $3\frac{1}{3}$ in length; depth about $2\frac{1}{2}$. Eye large, its diameter equal to the length of the snout. D. IX–I, 14; A. III, 12; Lat. l. 55. L. 15 inches. Great Lakes, Mississippi Valley, and northward. A game fish of some repute.

(*Perca chrysops* Raf. Ich. Oh. 1820, 28: *Labrax multilineatus* Kirtland, Bost. Jour. Nat. Hist. v, 21: *Roccus chrysops* Gill, Proc. Acad. Nat. Sci. Phila. 1860, 113: *Labrax osculatii*, *multilineata*, and *notata* Günther, i, 65, 67: *Labrax albidus* Dekay, New York Fauna, Fish. 1842, 13.)

bb. No teeth on base of tongue; second anal spine enlarged; jaws equal; scales on cheeks ctenoid; dorsal fins somewhat connected. (*Morone** Gill.)

d. Sides striped with black.

832. R. interruptus (Gill) J. & G.—*Yellow Bass.*

Brassy, tinged with olivaceous above; sides with 7 very distinct longitudinal black bands, darker than in the other species, those below the lateral line interrupted posteriorly, the posterior part alternating with the anterior. Body oblong-ovate, with the dorsal outline much arched. Head depressed, somewhat pointed, its profile concave. Eyes large, their diameter equalling length of snout. Mouth somewhat oblique, maxillary nearly reaching middle of orbit. Spines very robust; second anal spine $\frac{2}{5}$ length of head. Dorsal fins little connected. Head 3 in length; depth $2\frac{2}{3}$. D. IX–I, 12; A. III, 9; Lat. l. 50. L. 1 foot. Mississippi Valley, chiefly southward; north to Illinois.

(*Labrax chrysops* Girard, U. S. Pac. R. R. Surv. Fish. 1858, 29; not *Perca chrysops* Raf.: *Morone interrupta* Gill, Proc. Acad. Nat. Sci. Phila. 1860, 118.)

dd. Sides not striped with black.

833. R. americanus (Gmel.) J. & G.—*White Perch.*

Olivaceous; sides silvery, with faint lighter streaks. Body oblong-ovate; dorsal outline much arched; the head depressed above eyes, and rather pointed. Mouth rather small, somewhat oblique, maxillary nearly reaching the vertical from the middle of the orbit. Eye moderate, its diameter about equal to length of snout. Spines strong, the second anal spine nearly $\frac{1}{2}$ length of head. Dorsal fins considerably connected. Head 3 in length; depth about 3. D. IX–I, 12; A. III, 9;

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*Gill, Proc. Acad. Nat. Sci. Phila. 1860, 116: type *Perca americana* Gmel. *Morone* Mitch. Rept. Fish. N. Y. 1814, 18; is properly a synonym of *Perca*. (Meaning, if any, unknown.)

Lat. l. 50. Length scarcely a foot. Cape Cod to Florida, abundant, ascending all streams coastwise.

(*Perca americana* Gmel. Syst. Nat. I, pars iii, 1308, 1789: *Labrax rufus* Storer, Hist. Fish. Mass. 9: *Morone americana* Gill, Proc. Acad. Nat. Sci. Phila. 1860, 116: *Perca mucronata* Raf. Amer. Month. Mag. ii, 205: *Labrax americanus* Holbrook, Ich. S. C. 5: *Labrax rufus* and *pallidus* Günther, i, 65, 67.)

272.—STEREOLEPIS Ayres.

Jew Fishes.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 28: type *Stereolepis gigas* Ayres.)

Body oblong, somewhat elevated, little compressed. Head robust, the profile steeply elevated, the forehead broad and flattish. Edges of preopercle and interopercle serrate, becoming nearly entire with age. Crown, cheeks, and opercles scaly; snout, preorbital, and jaws naked. Scales small, not strongly ctenoid, their surface rugose with radiating striæ. Mouth large, wide, placed low; lower jaw prominent. Maxillary with a well-developed supplemental bone, extending to below the eye. Preorbital wide, only the anterior edge of the maxillary slipping under it. Teeth all villiform, in broad bands, on jaws, vomer, and palatines. Branchiostegals 7. Pseudobranchiæ very large. Gill-rakers very strong. Dorsal fin with 11 low, stout spines, the last spines very much shorter than the middle ones, and all depressible in a deep groove. Anal fin similar to soft dorsal, with 3 low, stout spines; caudal fin broad, nearly truncate; pectorals moderate; ventrals long. Pyloric cœca about 7. Size enormous, among the largest of Percoid fishes. (στερεός, firm; λεπις, scale.)

834. S. gigas Ayres.—*Jew-fish; Black Sea Bass.*

Brownish with large black blotches, becoming with age nearly uniform greenish black; vertical fins in the young with a conspicuous pale edge; ventrals black. Body and head robust; region from occiput to dorsal carinated. Soft parts of vertical fins scaly; spinous part naked; first dorsal spine prominent, curved. Ventrals reaching vent, one-fourth longer than the pectorals. Head 3; depth 3. D. X–I, 10; A. III, 8; Lat. l. 115. Pyloric cœca 7, long. L. 5 feet. Coast of California from San Francisco southward, not rare.

(Ayres, Proc. Cal. Acad. Sci. 1859, 28: *Stereolepis californicus* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 330.)

273.—POLYPRION Cuvier.

Stone Bass.

(Cuvier, Règne Anim. ii, 1817 : type *Polyprion cernium* Val.)

Body robust, moderately elevated, covered with small, firm scales, which extend on the vertical fins. Mouth large, the lower jaw projecting. Teeth in villiform bands on jaws, vomer, palatines, and tongue. Preopercle serrate; orbital region with spinous projections; a strong, rough, bony longitudinal ridge on the opercle. Dorsal fin continuous, low, with 11 strong spines; caudal rounded; anal with 3 spines, the third the largest; ventrals large; pectorals short. Spines of anal and ventrals somewhat serrate on the anterior edge. Vertebræ 13 + 13. Pyloric cœca about 70. Branchiostegals 7. (πολὺς, many; πριών, saw.)

835. P. oxygenius (Schn.) J. & G.—*Stone Bass; Wreck-fish; Cernier.*

Grayish brown, the caudal edged with white; young clouded with light and dark. Body robust, somewhat compressed; the back elevated. Mouth rather large, the scaly maxillary extending to opposite the posterior margin of the eye; lower jaw the longer. Supraocular region, scapula, suprascapula, preopercle, and a ridge on opercle spinigerous. Anal spines short, serrate anteriorly, the third much the longest. Head 3; depth 2½. D. XI, 12; A. III, 8; L. 6 feet. A very large fish of the coasts of Southern Europe and Africa; a single young specimen lately obtained in deep water by the United States Fish Commission. It resembles *Stereolepis*, but is much rougher.

(*Amphiprion americanus* Bloch & Schneider, 205, t. 47, 1801; erroneously ascribed to America (*nomen ineptum?*): *Epinephelus oxygeneios* Bloch & Schneider, 301: *Polyprion cernium* Valenciennes, Mém. du Mus. xi, 265: *Polyprion cernium* Cuv. & Val. iii, 215, pl. 42: *Polyprion cernium* Günther, i, 169: *Polyprion cernium* Day, Brit. Fish. 17.)

274.—SERRANUS Cuvier.

Sea Bass.

(Cuvier & Valenciennes, Hist. Nat. Poiss. ii, 210, 1828: type *Perca scriba* L.)

Body oblong or moderately elongate, covered with rather small, ctenoid scales. Scales of the lateral line quadrilateral or subtriangular, ctenoid. Head oblong. Mouth wide, oblique. Maxillary without supplemental bone. Outer series of teeth more or less enlarged and canine-like, the canines sometimes very small, sometimes large, commonly numerous and developed along the sides of the lower jaw,

as well as along the front; teeth mostly fixed. Preopercle serrate behind; opercle ending in 2 flat spines. Cheeks and opercles scaly. Gill-rakers shortish, stout. Fins little scaly. Dorsal fin continuous or emarginate, with 10 strong spines and 11–15 soft rays. Anal spines well developed. Caudal fin lunate or truncate. Occipital crests little developed. Pyloric cœca few. Vertebræ 10 + 14. Species very numerous in warm seas. Several modern genera are here included, some of which may perhaps merit restoration.

The typical species of *Centropristis* differs from *Serranus scriba* and its relatives in numerous respects, notably in the scarcely differentiated canines, the broader bands of teeth, the broader head, the stronger serræ on the opercle, the rudimentary dorsal groove and nearly naked spinous dorsal (in *Serranus* proper, of which we have no typical species, there is no trace of a groove and the dorsal is more scaly), the larger scales, and the shorter soft dorsal. Each of these characters is shared with some of the species now referred to *Serranus*, and any line of division of the two groups is simply arbitrary, at least until the species are better known.

(*Serran* or *serrano*, a vernacular name; from the Latin *serra*, a saw.)

* Caudal trilobate or trifurcate.
† Dorsal spines simple. (*Centropristis** Cuvier.)

836. S. atrarius (L.) J. & G.—*Black Fish; Black Sea Bass.*

Dusky brown or black; more or less mottled, with traces of pale longitudinal streaks along the rows of scales; young greenish, often with a dark lateral band, sometimes broken up, forming cross-bars; dorsal fin with several series of elongate, whitish spots, forming interrupted lines; other fins dusky, mottled. Body ovate, robust, the back somewhat elevated; axis of body below the middle of the depth. Head large, thick, little compressed, somewhat pointed; top of head naked; cheeks and opercles scaly; scales on cheeks in about 11 rows. Mouth oblique, low, rather large, the premaxillary below the level of the eye; lower jaw prominent; maxillary broad, its upper edge anteriorly slipping under the edge of the broad preorbital, which is nearly as wide as the eye. Eye large, wider than interorbital space, less than snout, $4\frac{1}{4}$ in head. Gill-rakers long. Canines very small, scarcely differentiated. Teeth all fixed, the bands rather broader than usual. Dorsal spines rather

*Cuvier, Règne Anim. ed. 2, 1829: type *Centropristis nigricans* Cuv. = *Perca atraria* L. (*χέντρον*, spine; *πριότης*, saw.)

strong, not filamentous, the middle ones rather higher than the posterior, which are considerably lower than the soft rays, the highest spine as long as from snout to middle of eye. Anal short and high, its spines graduated. Pectoral very long, $1\frac{1}{4}$ in head, reaching vent. Ventrals long, nearly reaching vent, inserted below front of base of pectorals. Caudal slightly double concave; fins little scaly, except at base; a rudimentary groove at base of spinous dorsal, over which scales do not pass. Head $2\frac{3}{4}$; depth $2\frac{2}{3}$. D. X, 11; A. III, 7; Lat. l. 50; cœca 4–7. L. 12 inches. Cape Cod to Florida; generally abundant.

(*Perca atraria* L. Syst. Nat.: *Centropristis nigricans* Cuv. & Val. iii, 37: *Centropristis atrarius* Günther, i, 86: *Centropristis atrarius* Holbrook, Ich. S. Car. 42.)

†† Dorsal spines produced in long filaments. (*Triloburus** Gill.)

837. S. trifurcus (Linn.) J. & G.

Grayish, with purple reflections; sides with 6 dusky gray vertical bars meeting across the back; silvery below; head bronze, with blue streaks in front of eye; dorsal shaded with olive, a large irregular black spot near its middle; dorsal filaments red. Body slender, little elevated, subfusiform. Mouth large, nearly horizontal, maxillary reaching to opposite middle of orbit. Preopercle finely and evenly serrated. Most of the dorsal spines and the three lobes of the caudal produced and filamentous. Head 3; depth about 4. D. X, 11; A, III, 8; Lat. l. about 55. South Atlantic coast; not very common.

(*Perca trifurca* Linn. Syst. Nat. i, 489: *Centropristis trifurca* Holbrook, Ich. S. Car. 1860, 49: *Anthias furcatus* Günther, i, 91.)

** Caudal lunate or truncate.

‡ Serræ on lower limb of preopercle small, not antrorse.

a. Canine teeth small.

b. Dorsal fin continuous, none of the spines elevated.

c. Serræ at the angle of the preopercle forming one or two groups of radiating spines; soft dorsal rather short. (*Diplectrum*† Holbr.)

838. S. fasciularis Cuv. & Val.—*Squirrel Fish; Serrano.*

Brownish above, silvery below, sides marked with 7 or 8 longitudinal dark-blue lines; head marked with blotches and lines of dark blue; three or four distinct blue stripes across top of head; two across preorbital, the lower forked; fins barred with blue and pale yellow. Body elongate, not elevated. Head naked above; mouth rather large, maxillary narrow, nearly reaching posterior margin of orbit. Dorsal and

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* Gill, Cat. Fishes East Coast N. Am. 1861, 30; not characterized: type *Perca trifurca* L. (τρεῖς, three; λοβὸς, lobe,; οὐρά, tail.)

†Holbrook, Ich. S. C. ed. 1, 32, 1859: type *Serranus fasciularis* C. & V. (δις, two; πλῆκτρον, spur.)

anal spines slender, rather low, the former continuous with the soft rays; second anal spine small; caudal deeply emarginate; pectorals shortish, reaching tips of ventrals. Serræ of preopercle forming two diverging groups of long spines at its angle; lower limb of preopercle entire. Head 3; depth 4. D. IX, 12; A. II, 7; Lat. l. about 65. West Indies, north to South Carolina; not rare.

(Cuv. & Val. ii, 245: *Centropristis fascicularis* Günther, i, 83: *Diplectrum fasciculare* Holbrook, Icth. S. C. 1860, 35.)

cc. Serræ of preopercle simple. (*Haliperca** Gill.)

d. Soft dorsal of more than 13 rays.

839. S. subligarius (Cope) J. & G.

Chocolate-brown; cheeks, interopercle, maxillary, and mandible with a coarse network of white lines; yellowish below; body with 5 vertical cross-bands, 2 on the caudal peduncle and 2 above anal fin; pectoral and caudal with small brown spots; second dorsal and anal brown, with rows of small white spots. Form elongate-oval. Head narrow, conical; profile regular; mandible projecting; opercle with three points; maxillary smooth; cheeks and opercles scaly, those on the latter minute; scales on the vertex ceasing behind posterior margin of pupil. Median dorsal spines subequal; median anal spines extending beyond base of anal fin; caudal truncate. Teeth and armature of preopercle not described, but doubtless much as in *S. atrarius*. D. X, 14; A. III, 8; scales $5\frac{1}{2}$–48–18. Pensacola, Fla. (*Cope.*)

(*Centropristis subligarius* Cope, Proc. Acad. Nat. Sci. Phila. 1870, ——.)

bb. Dorsal fin emarginate, some of the anterior spines being elevated; soft dorsal long; preopercle simply serrate. (*Paralabrax*† Girard.)

840. S. clathratus (Grd.) Steind.—*Rock Bass; Cabrilla.*

Grayish green, with obscure, broad dusky streaks and bars, which form reticulations on the sides; sides often mottled or shaded with bluish or yellowish, but usually without distinct spots; a broad dark shade near axis of body, below which the color is nearly plain silvery gray. Preorbital narrow, its least width slightly more than half the diameter of the orbit. Maxillary broad, much expanded at tip, its greatest width two-thirds diameter of eye. Gill-rakers rather long, 22 below the angle. Pectorals long, $1\frac{1}{2}$ in head; ventrals $1\frac{3}{4}$ in head; third, fourth, and fifth dorsal spines about equal, the second spine

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*Gill, Proc. Acad. Nat. Sci. Phila. 1862, 236: type *Serranus bivittatus* C. & V. (ἅλς, sea; πέρκη, perch.)

†Girard, Proc. Acad. Nat. Sci. Phila. 1856, 131: type *Labrax nebulifer* Grd. = *Atractoperca* and *Gonioperca* Gill. (παρά, near; λαβραξ, *Labrax.*)

half the length of the third, the third less than length of snout and orbit; second anal spine longest. Top of head mostly naked; a few scales along the median line behind the pupil. Head 3; depth $3\frac{1}{4}$; eye $1\frac{2}{3}$ in snout. D. IX, I, 13; A. III, 7; Lat. l. 73. L. 18 inches. Coast of California; abundant southward.

(*Labrax clathratus* Grd. Proc. Acad. Nat. Sci. Phila. 1854, 143: *Paralabrax clathratus* Grd. U. S. Pac. R. R. Surv. 34: *Paralabrax clathratus* Günther, i, 62: *Atractoperca clathrata* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 165.)

841. S. maculofasciatus Steindachner.—*Cabrilla.*

Olive brown, everywhere above thickly covered with dark hexagonal or roundish spots, which cover more space than the ground color, the latter forming reticulations around them; spots on back more or less confluent, most distinct and tinged with orange on sides of head, branchiostegals, and base of pectorals; about 7 oblique dusky cross-bars along the sides, in which the spots are deeper in color and more confluent; a bluish stripe from eye across cheeks; lips plumbeous; lower side of head yellow; spinous dorsal dusky, the membrane of third spine black; soft dorsal with bronze spots; caudal with confluent dark spots at base and bronze spots at tip; other fins mottled with bronze and dusky. Preorbital very wide, wider than eye; maxillary narrow, reaching middle of pupil, its width about half that of eye; gill-rakers short, 14 below angle of arch; pectoral short, $1\frac{1}{2}$ in head; ventrals $1\frac{3}{4}$; third and fourth dorsal spines elevated, the second two-fifths the height of the third, which is longer than snout and orbit; second anal spine shorter than third; top of head scaled on the middle line to opposite front of pupil, naked on sides; eye half as long as snout. Head 3; depth 3. D. X, I, 14; A. III, 7; Lat. l. 90 (72 pores). L. 12 inches. Coast of California, abundant from San Diego southward.

(Steindachner, Ichthyol. Notizen vii, 969, 1868; Vaillant & Bocourt, Miss. Sci. au Mex. iv, 72, 1874.)

842. S. nebulifer (Grd.) Steind.—*Johnny Verde.*

Greenish with irregular pale and dark mottlings and traces of dark oblique cross-bars, the colors having a washed or faded appearance; fins dull bluish black, mottled; lower side of tail with wavy whitish streaks; under side of head salmon color; preorbital, suborbital, and cheeks profusely marked with round orange spots; a dark streak downward and backward from eye; caudal mottled. Preorbital very broad, its least width about equal to the diameter of the eye; maxillary rather narrow, half as broad as the eye, reaching middle of pupil; gill-rakers shortish,

about 15 on lower part of arch; pectorals rather short, about $\frac{2}{3}$ the length of the head; ventrals 2–$2\frac{1}{2}$ in head; first 2 dorsal spines very short, the third very high, much higher than any of the others; second spine one-third to one-fourth length of third, which is longer than snout and orbit; second anal spine as long as third; top of head closely scaled to beyond front of eyes. Head $2\frac{3}{4}$; depth $3\frac{1}{2}$; eye less than half the snout. D. X, I, 14; A. III, 7; Lat. l. 86. L. 18 inches. Coast of California, from Monterey southward; abundant.

(*Labrax nebulifer* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 142: *Paralabrax nebulifer* Girard, U. S. Pac. R. R. Surv. x, 33, pl. xii: *Paralabrax nebulifer* Günther, i, 62; Steindachner, Ichthyol. Beiträge, iii, 1.)

‡‡ Serræ on lower edge of preopercle, large, spur-like, directed forward. (*Plectropoma** Cuvier.)

843. S. chlorurus (C. & V.) J. & G.—*Negrita.*

Color uniform blackish, strongly tinged with violet; pectoral and caudal yellow. Mouth rather large, the maxillary without supplemental bone, extending to the front of the pupil; lower jaw projecting; nine rows of scales on the cheek; preopercle finely serrate above, its lower margin withseveral antrorse teeth. Body elevated, somewhat compressed. Pectoral long, extending beyond ventrals; caudal forked; second and third spines of anal about equal. Head $2\frac{2}{3}$; depth $2\frac{1}{5}$. D. X, 15; A. III, 7; Lat. l. about 65. West Indies, north to Garden Key, Florida.

(*Plectropoma chlorurum* Cuv. & Val. Hist. Nat. Poiss. ii, 406, 1828: *P. chlorurum* Günther, i, 167: *P. chlorurum* Vaill. & Boc. Miss. Sci. Mex. iv, 104: *Plectropoma nigricans* Poey, Memorias Cuba, i, 71, 1851: *Hypoplectrus nigricans* Poey, Synopsis Pisc. Cubens. 290.)

275.—TRISOTROPIS Gill.

(*Parepinephelus* Bleeker.)

(Gill, Proc. Acad. Nat. Sci. Phila. 1865, 104: type *Perca guttata* Bloch.)

Characters of *Epinephelus*, except that the lateral crests on the cranium are well developed, like the median one. "This genus is recognizable externally by its oblong form, the peculiar structure of the nostrils, the form of the fins, etc., but is more especially distinguished by the development of the skull, which differs in a very marked manner

*Cuvier, Règne Anim. ii, 142, 1829: type *Bodianus maculatus* Bloch. This group has been separated from *Serranus* on account of the strong antrorse teeth of the lower edge of the preopercle. It has been divided by Professor Gill into several genera, which have been adopted and defined by Professor Poey, but their necessity is not evident. It is at best an artificial group, and some of the current species (*P. afrum*, etc.) belong to *Epinephelus*. (πλῆχτρον, spur; πῶμα operculum.)

from that of *Epinephelus*. * * * The skull differs from that of *Epinephelus* by the wider interorbital area, the parallelism and continuation of the lateral crests forward to the middle of the orbits inclosing an elongated parallelogram, the surface of which, especially between the orbits, is more uniform; the absence of a frontal crest, the simple curvature or straightness of the naso-vomerine ridge and absence of the angle at the suture between the nasals and vomer." (*Gill.*) The species of this group have the anal III, 11, or III, 12. They reach a very large size, and are abundant in the tropical seas. (τρεῖς, thrice; τρόπις, a keel, in allusion to the presence of the three parallel elevated keels on the top of the cranium, which distinguishes this genus from *Epinephelus*.)

844. T. brunneus Poey.—*Black Grouper; Abadejo.*

Clear brown, covered with spots of darker brown, irregular in size and form; pectorals reddish; ventrals bluish; other fins dusky; maxillary with a supplemental bone; preopercle sinuous; third dorsal spine not a third as high as the body; soft dorsal highest at its middle. Head $3\frac{1}{8}$ in total length; depth about 4. Eye $7\frac{1}{2}$ in head. D. XI, 16; A. III, 11; Lat. l. about 110; cœca 15. (*Poey.*) West Indies, north to Virginia.

(*Serranus brunneus* Poey, Memorias Cuba, ii, 131, 1858; Goode & Bean, Proc. U. S. Nat. Mus. 1879, 143.)

845. T. falcatus Poey.—*Scamp.*

Brown, with irregular darker spots, none on the head or belly; pectorals edged with blackish and orange. Body moderately compressed. Maxillary reaching vertical from posterior margin of eye; lower jaw much projecting beyond the upper; upper jaw with teeth in a single series, with a short band in front; 4 canines; lower jaw with teeth in two series, and with several canines at the symphysis; teeth on vomer, in an angular patch; palatine teeth in a single series. Sixth dorsal spine longest; caudal deeply forked, the external rays nearly twice the length of the middle ones. Head $2\frac{7}{9}$; depth about 3. D. XI, 17; A. III, 11; L. lat. 120; L. transv. $\frac{25}{43}$. (*Goode & Bean.*) West Indies, north to Pensacola.

(Poey, Memorias, ii, 138; Goode & Bean, Proc. U. S. Nat. Mus. ii, 140, 1879.)

846. T. microlepis Goode & Bean.

Maxillary reaching perpendicular from posterior margin of orbit; each jaw with two canines; upper jaw with an inner series of villiform and an outer series of large slender conical teeth curved inward; lower

jaw with two series of conical teeth, the inner the largest and movable; vomer and palatines with very small villiform teeth. Preopercle with fine denticulations on its posterior margin and some coarser ones at the angle. Third and fourth dorsal spines highest, the first slightly higher than the second. Color not described. Head $2\frac{1}{2}$–$2\frac{2}{3}$; depth $3\frac{1}{2}$. D. XI, 18; A. III, 10; L. lat. 145; L. transv. $\frac{30}{60}$. (*Goode & Bean.*) Western coast of Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. ii, 1879, 141.)

276.—EPINEPHELUS Bloch.

Groupers; Merous.*

(Bloch, Ichth. 1793; Bloch & Schneider, Syst. Ichth. 1801, 299: type *Epinephelus ruber* Bloch.)

Body stout, compressed, covered with small ctenoid scales, which are often somewhat embedded in the skin; 75–140 in the course of the lateral line; scales of the lateral line triangular, cycloid; soft parts of the vertical fins generally more or less scaly. Top of cranium narrow, with the median crest only developed, the lateral keels being obsolete. Preopercle moderately serrate behind, its lower limb nearly or quite entire, rarely with an antrorse spine; opercle with two strong spines. Mouth large; maxillary with a well-developed supplemental bone. Canine teeth few, large, in the front of the jaws; enlarged teeth of the inner series of each jaw depressible. Gill-rakers short. Dorsal spines usually 9 or 11, not filamentous, the last ones somewhat shorter than the middle ones. Anal spines 3, the second usually the larger; the number of soft rays 7–9. Caudal fin rounded. Pyloric cœca usually few (usually 10–20). Species very numerous, most of them of large size, abounding in all the tropical seas, where they are among the most valuable food-fishes. (ἐπινεφελος, clouded; in allusion to a supposed adipose membrane covering the eye.)

* Dorsal spines 11.

a. Pyloric cœca less than 35. (*Epinephelus.*)

847. E. capreolus (Poey) J. & G.—*Cabrilla.*

Brown, everywhere covered with round dark spots regularly placed, largest below, smallest near the dorsal fin, those below about as large as the pupil; two larger black spots at base of spinous dorsal, partly on the fin; a few roundish pale spots on the body; fins all spotted; pec-

* A corruption of the Portuguese name, *Garrupa.*

torals and ventrals finely mottled, the pectorals with a narrow pale edge. Body ovate, rather slender, the head long and pointed. Lower jaw slightly projecting; maxillary extending nearly to the posterior border of the orbit; four small canines in front of lower jaw. Preopercle slightly emarginate, its edge finely serrate. Scales small, those on cheeks, breast, and top of head very small. Caudal rounded; pectoral fin extending beyond tips of ventrals, to vent; second anal spine rather strong. Head $2\frac{2}{3}$; depth 3. D. XI, 16; A. III, 7; Lat. l. about 80. Florida to the Caribbean Sea; abundant in the West Indies; an excellent food-fish. The synonymy of this species is much confused, and the name to be adopted is uncertain.

(? *Perca maculata* Bloch, Ichth. 181, taf. 343, 1797; not *Holocentrus maculatus* Bloch, Ichth. taf. 242, which is also apparently an *Epinephelus*: ? *Sparus atlanticus* Lacép. Hist. Nat. Poiss. iv, 158, 1802 (based on Bloch.): ? *Serranus impetiginosus* Müller & Troschel, Schomburgk, Excurs. Barbadoes, 665: ? *Serranus maculatus* and *impetiginosus* Günther, i, 130, 142: *Serranus capreolus* Poey, Memorias, ii, 145: *Serranus capreolus* Vaillant, Miss. Sci. au Mex. iv, 87.)

848. E. drummond-hayi Goode & Bean.—*Hind; John Paw.*

Color umber brown, everywhere densely covered with white stellate spots except on the lips and belly; about 40 of these between gill-openings and base of caudal; along the sides the spots often coalesce. Preopercle evenly serrate. Eye $6\frac{1}{3}$ in head. Caudal truncate or slightly emarginate. Head $2\frac{2}{3}$; depth $2\frac{2}{3}$. D. XI, 16; A. III, 9; scales 32–125–57. Gulf coast of United States. (*Goode & Bean.*)

(Goode & Bean, Proc. U. S. Nat. Mus. i, 174, 1878.)

849. E. morio (Cuv.) Gill.—*Red Grouper.*

Brownish, marbled with ash; salmon color below; soft parts of the vertical fins margined with blue. Body oval, compressed above; profile oblique, gently curved; mouth terminal, large, somewhat oblique; maxillary reaching beyond eye. Eye about as long as snout. Head $2\frac{1}{2}$; depth 3. D. XI, 17; A. III, 9; Lat. l. 106; cœca 28. Atlantic coast, chiefly southward.

(*Serranus morio* Cuv. & Val. ii, 285: *Serranus morio* Günther, i, 142: *Serranus erythrogaster* Holbrook, Ich. S. C. 1860, 34.)

850. E. nigritus (Holbrook) Gill.—*Black Grouper; Jew-fish.*

Bluish black above, lighter below; no red; no traces of markings on body or fins. Body oblong, thick, tapering backward. Mouth large, very oblique, lower jaw projecting. A spine on the lower limb of the preopercle in front of the angle. Head $2\frac{2}{3}$; depth about $2\frac{3}{4}$. D. X, 15;

A. III, 9; scales 24–115–52. Gulf of Mexico, north to South Carolina; reaches a weight of 300 pounds.

(*Serranus nigritus* Holbrook, Ich. S. C. 1860, 177: *Serranus nigritus* Günther, i, 134; Goode & Bean, Proc. U. S. Nat. Mus. 1878, 182.)

aa. Pyloric cœca numerous (50–70). (*Hyporthodus** Gill.)

851. E. niveatus (Cuv. & Val.) Poey.

Brownish olive; sides with many large, light blue spots, which are arranged in about 5 transverse rows; a large quadrangular black spot crossing caudal peduncle above and running down on sides to below the lateral line. Body oblong, compressed, highest forwards; mouth large, oblique, maxillary reaching beyond middle of orbit; lower jaw slightly the longest; membranes of vertical fins scaled half way up; second anal spine about as long as third and much stronger; top of head entirely scaled, except in front of nostrils. Eye large, as long as snout. Head $2\frac{1}{2}$; depth $2\frac{2}{3}$. D. XI, 14; A. III, 9; Lat. l. about 85. West Indies to Florida; accidental northward.

(*Serranus niveatus* Cuv. & Val. ii, 380: *Serranus niveatus* Günther, i, 130: *Hyporthodus flavicauda* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 98, from Newport, R. I.)

** Dorsal spines 9. (*Bodianus*† Bloch.)

852. E. punctatus (L.) J. & G.—*Butter-fish; Nigger-fish; Coney.*

Olivaceous yellow or red, covered with small, round, dark-edged spots of blue; one or two black spots on the tip of the chin and one on the caudal peduncle; colors brilliant and variable. Maxillary not reaching posterior margin of eye; eye $5\frac{1}{2}$ in head; preopercle finely serrate; its lower limb entire; caudal truncate; skull channelled between the eyes, its upper surface smooth. Head $2\frac{3}{4}$. D. IX, 15; A. III, 9; Lat. l. 85. Pyloric cœca 8. Vertebræ 10 + 14. (*Günther.*) Size small; flesh soft. West Indies, north to Florida Keys; abundant.

(*Perca punctata* L. Syst. Nat. x, 291, 1758: *Serranus ouatalibi* Cuv. & Val. ii, 381, 1829 (red variety): *Serranus ouatalibi* Günther, i, 120: *Serranus guativere* Cuv. & Val. ii, 383: *Serranus carauno* Cuv. & Val. ii, 383: *Enneacentrus punctatus* Poey, Rep. Fis.-Nat. Cuba, 1868, 288: *Enneacentrus punctatus* Goode, Bull. U. S. Nat. Mus. v, 59.)

277.—PROMICROPS Gill.

(Gill, MSS.; Poey, Synopsis Piscium Cubensium, 1868, 287: type *Serranus guasa* Poey.)

"This genus has the characters of *Epinephelus*, except the cranium, which resembles that of *Trisotropis* by the great interorbital width.

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*Gill, Proc. Acad. Nat. Sci. Phila. 1861, 98: type *Hyporthodus flavicauda* Gill = *Serranus niveatus* juv. (ὕπο, below; ορθος, straight; ὀδοῦς, tooth.)

†Bloch Ichthyol; Bloch & Schneider, Syst. Ichth. 1801, 330: type *Bodianus guttatus* Bloch. (From *Bodiano*, a Portuguese name of various similar fishes.)

We may notice the eye well advanced. It further differs in the dentition and by the extreme division of its pyloric appendages. The teeth are in a large band, a little narrower in the lower jaw; the external margin shows a row of teeth a little stronger, especially the two first, but there are no differentiated canines; the extreme inner series in front has some stronger teeth. The palatine and vomerine teeth are in finer bands. The cœca and their divisions are innumerable." (*Poey.*) Elsewhere the cranium is described as short, broad, and flat, the occipital crest very low. Size enormous, as in the genus *Stereolepis.* This genus and *Trisotropis* should probably be considered as sections of *Epinephelus.* (προ, before; μικρος, small; ωψ, eye; in allusion to the shortness of the anterior part of the cranium, due to the advancement of the orbit.)

853. P. guasa Poey.—*Guasa.*

Yellowish olivaceous, with numerous brown spots. Body more compressed above than below. Mouth large, maxillary reaching beyond the orbit; preopercle feebly serrated; opercle with 3 flat points; fins all very low, caudal rounded. Head $3\frac{1}{6}$; depth 4. D. XI, 16; A. III, 8. (*Poey.*) West Indies, north to Florida; reaches a weight of 400 or 500 pounds.

(*Serranus guasa* Poey, Mem. ii, 141, 1858.)

278.—DULES Cuvier.

(Cuvier, Règne Anim. ed. 2d, ii, 1829: type *Dules auriga* C. & V.)

Body oblong, ovate, compressed and elevated, covered with rather large scales. Mouth large, the lower jaw projecting; the maxillary reaching to opposite the middle of the eye. Teeth moderate, the anterior in the upper jaw enlarged, wide-set, but hardly forming canines. Preopercle sharply serrate; opercle with 2 strong spines. Dorsal with 10 spines, anal with 3; the third dorsal spine filamentous, the second anal spine longest. Branchiostegals 6. Fishes of the warm seas, sometimes entering rivers. (δουλος, a slave; the fish being under the lash of the long dorsal spine.)

854. D. auriga Cuv. & Val.—*Charioteer; Coachman.*

Yellowish gray, with two or three darker cross-bands and faint dark longitudinal streaks. Opercle with two or three strong spines, the upper one the largest; pectoral and ventral fins large; third dorsal spine filamentous, reaching the middle of the caudal; caudal truncate. D. X, 13; A. III, 7; Lat. l. 46. Vert. 10 + 14. Tropical parts of the Atlantic; said to have been taken on our coast.

(Cuv. & Val. iii, 112; Günther, i, 206.)

279.—RHYPTICUS Cuvier.

Soap-fishes.

(Cuvier, Règne Anim. ii, 1829: type *Anthias saponaceus* Bloch & Schneider.)

Body oblong ,compressed, covered with small, smooth embedded scales. Mouth oblique, rather large, the lower jaw prominent, the maxillary with a supplemental bone, reaching to or beyond the pupil; preorbital rather narrow; no canines; broad bands of villiform teeth on jaws, vomer, and palatines. Preopercle crescent-shaped, without angle or serratures, its margin with spinous teeth above. Opercle with spines. Dorsal fin with two or three low stout spines, sometimes separated by a notch from the soft rays; anal fin without spine, or with an embedded rudiment; caudal fin rounded behind. Ventrals small. Pectorals short and rounded. Tropical seas. (*ῥυπτικός*, washing; from the "soapy" skin.)

a. Dorsal spines 2, more or less connected with the soft rays. (*Promicropterus** Gill.)

855. R. maculatus Holbr.

Olive brown above, with scattered whitish spots; below pale slate color. Back regularly arched from snout to caudal fin. Mouth large, maxillary extending beyond orbit; lower jaw longer than upper, and projecting much beyond it in closed mouth. Preopercle with 2 stout spines; opercle with 3. Pectorals rather large. Vertical fins high. Dorsal spines slightly connected with the soft rays. Head $3\frac{1}{3}$; depth 3. D. II, 25; A. 15. North Carolina to the West Indies.

(Holbrook, Ich. S. C. 1860, 42; Günther, i, 173.)

856. R. decoratus (Gill) J. & G.

Brownish, irregularly maculated with light spots about as large as the pupil, these generally with a blackish centre; the spots are sometimes confluent and are most numerous on the sides. Eye equal snout, $5\frac{1}{2}$ in length of head. Head 3; depth $3\frac{1}{2}$. D. II, 26; A. 16. Tropical seas; accidental at Newport, R. I. (*Gill.*)

(*Promicropterus decoratus* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 164.

857. R. pituitosus Goode & Bean.

Very light brown, with numerous small brown spots; the diameter of the largest, one-third that of eye; these absent on abdomen and throat; traces of light margins to the vertical fins. Upper jaw nearly reaching

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*Gill, Proc. Acad. Nat. Sci. Phila. 1861, 53: type *Rhypticus maculatus* Holbr. (*πρό*, before; *μικρὸς*, small; *πτερὸν*, fin.)

the vertical from posterior margin of orbit. One continuous dorsal; dorsal and anal fins higher posteriorly, the longest rays reaching base of caudal. Eye twice the length of snout. Head more than one-third length of body; depth $3\frac{1}{2}$. D. II, 27; A. 15; Lat. l. 90; L. transv. $\frac{9}{30}$. (*Goode & Bean.*) Key West, Fla.

(Goode & Bean, Proc. U. S. Nat. Mus. ii, 341, 1879.)

Family LXXXVII.—PRIACANTHIDÆ.

(*The Big Eyes.*)

Body oblong or ovate, compressed, covered with small, firm, rough scales; all parts of the body and head, even the snout and maxillaries, being densely scaly. Head deep. Mouth large, very oblique, the lower jaw prominent. Villiform teeth on jaws, vomer, and palatines, none on the tongue. Premaxillaries protractile. Maxillary broad, without supplemental bone, not slipping under the very narrow preorbital. Eye very large, forming about half the length of the side of the head. Posterior nostril long, slit-like. Preopercle more or less serrated, one or more strong spines at its angle; operculum very short, ending in two or three points behind. Gill-membranes separate, free from the isthmus. Pseudobranchiæ large. Gills 4, a slit behind the fourth. Gill-rakers long. Branchiostegals 6. Lateral line continuous. Dorsal fin continuous, with about 10 spines, which are depressible in a groove; anal spines 3, the soft part long, similar to the soft dorsal; ventrals large, thoracic, I, 5; pectorals small, rounded; caudal fin truncate or lunate. Spines of fins generally rough with small serræ. Air-bladder large. Pyloric cœca few. Small carnivorous fishes of the tropical seas; mostly rose-colored in life. Genus 1; species about 20.

(*Percidæ*, group *Priacanthina* Günther, i, 215–221.)

280.—PRIACANTHUS Cuiver.

Big Eyes.

(Cuvier, Règne Anim. ii, 1817: type *Priacanthus macrophthalmus* Cuvier.)

Characters of the genus included above. (πρίων, saw; ἄκανθα, spine; from the serrature of the spines.)

a. Body more than twice as long as deep; scales small. (*Priacanthus.*)

858. P. macrophthalmus Cuv. & Val.—*Big Eye.*

Uniform red, fins edged with dusky. Body oblong, compressed, but little elevated. Gape of mouth subvertical, maxillary passing front of

eye. Head completely scaled. Eye about one-half length of head, more than 6 times width of preorbital. Ventrals long, reaching front of anal; pectorals small, not longer than eye. Lateral line following the curve of the back. Head $3\frac{1}{4}$; depth $2\frac{2}{3}$. D. X, 14; A. III, 15; Lat. l. 85. West Indies; occasional on our coast.

(Cuv. & Val. iii, 95; Günther, i, 215.)

aa. Body not twice as long as deep; scales large. (*Pseudopriacanthus* Bleeker.)

859. P. altus Gill.

Nearly uniform orange-red in life; vertical fins dotted with black; ventrals black. Body oblong, compressed and elevated. Profile very oblique; snout extremely short; gape of mouth very oblique, maxillary reaching to below orbit. Eye about one-half length of head. Spines stouter than in *P. macrophthalmus.* Scales much larger and rougher. Lateral line running obliquely upwards in front, then abruptly turning downwards. Ventrals large, extending beyond origin of anal. Preopercle and opercle coarsely serrate at angle and on lower limb; angle of preopercle with 2 spines, upper limb simply roughened. Caudal fin rounded. Head $2\frac{1}{2}$; depth $1\frac{1}{2}$. D. X, 11; A. III, 9; Lat. l. 45. Coast of New England; not common.

(*Priacanthus altus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 132.)

Family LXXXVIII.—SPARIDÆ.*

(*The Sparoid Fishes.*)

Body oblong, more or less elevated, covered with moderate-sized adherent scales, which are generally more or less strongly ctenoid, sometimes almost cycloid ("sparoid"). Head large, the skull often with traces of the cavernous structure seen in *Sciænidæ.* No suborbital stay. Mouth moderate or large, terminal, low, nearly horizontal. Premaxillaries protractile; maxillary without supplemental bone, for its whole length, slipping into a sheath formed by the edge of the broad preorbital; teeth villiform, cardiform, incisor-like or molar; canines sometimes present; vomer, palatines, and tongue with or without teeth; gills 4, a large slit behind the fourth; pseudobranchiæ large; gill-rakers moderate; branchiostegals 4–7; gill-membranes separate, free from the isthmus. Edge of preopercle serrated or entire; opercle usually without spines; sides of head generally scaly. Dorsal fin continuous or deeply notched,

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*Including 87 *Pristipomatidæ*, and 88 *Sparidæ* of the artificial key to families, on page 77.

the spines strong, usually depressible into a groove. Anal fin similar to soft dorsal, with 3 spines. Ventrals thoracic, I, 5, commonly with an accessory scale-like appendage. Caudal fin rounded or forked. Lateral line continuous, not extending upon the caudal fin. Pyloric cœca few or many. Air-bladder present, usually simple. Genera 55; species about 450, abounding in the seas of temperate and tropical regions. Those with incisor teeth only are chiefly herbivorous, the others carnivorous. The three principal subdivisions given below have been often taken as separate families.

(*Sparidæ*, *Pristipomatidæ* and *Percidæ* pts. Günther, i, 175–211, 272–339, and 412–499, exclusive of certain genera.)

a. Teeth all conical and pointed; no incisors nor molars, preopercle serrate; pyloric cœca few; carnivorous.

b. Vomer with teeth.

c. Dorsal fin deeply emarginate; teeth all villiform, in narrow bands. (*Xenichthyinæ*) ..... XENICHTHYS, 281.

cc. Dorsal fin continuous; canines more or less developed. (*Lutjaninæ.*) LUTJANUS, 282.

bb. Vomer, palatines, and tongue toothless.

d. Dorsal fin continuous.

e. Caudal fin lunate or forked; profile convex. (*Pristipomatinæ.*)

f. Mouth small; dorsal and anal fins naked or scaly at base only. POMADASYS, 283.

ff. Mouth large; soft parts of dorsal and anal densely scaly throughout. DIABASIS, 284.

ee. Caudal fin convex; profile concave. (*Lobotinæ.*)

h. Jaws with bands of villiform teeth, in front of which are a series of larger ones; no teeth on vomer or palatines. LOBOTES, 285.

aa. Teeth on the sides of the jaws molar; preopercle entire; pyloric cœca few; no teeth on vomer, palatines, or tongue; carnivorous. (*Sparinæ.*)

j. Front teeth conical, not at all compressed ..... SPARUS, 286.

jj. Front teeth compressed, incisor-like ..... DIPLODUS, 287.

aaa. Teeth in front incisor-like; no molars; pyloric cœca many; herbivorous.

m. Vomer toothless; fins mostly scaleless. (*Girellinæ.*)

n. Incisors trifid; cheeks scaly; opercles naked; dorsal spines 14 or 15 ..... GIRELLA, 288.

mm. Vomer with teeth; soft fins densely scaly; incisors lanceolate. (*Pimelepterinæ*)

o. Incisors with horizontal backward-projecting roots, the band of small teeth behind them narrow. PIMELEPTERUS, 289.

oo. Incisors without evident roots, the band of small teeth broad; soft dorsal and anal many-rayed, much longer than spinous dorsal ..... SCORPIS, 290.

281.—XENICHTHYS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 82: type *Xenichthys xanti* Gill, from Lower California.)

Body moderately elongate, subfusiform, compressed; head conic, little compressed; eyes large, anterior; preorbital rather narrow, oblique;

preoperculum pectinate behind; mouth rather small, very oblique; chin much projecting, a pore on each side of it at the symphysis; teeth very small, recurved, in narrow bands in each jaw; vomer with a rhomboid patch of very minute teeth; palatines nearly toothless; tongue slightly rough; branchiostegals 7; pseudobranchiæ present; scales small, firm, ctenoid; lateral line continuous; dorsal fins separate or connected by a low membrane; the first received into a groove, and composed of about 10 slender but rigid spines; second dorsal low; anal fins with 3 graduated spines and 10 to 20 rays; caudal fin emarginate, with rounded lobes; ventrals with a pointed axillary scale. Pacific Ocean. (ξενος, strange; ἰχθὺς, fish.)

a. Anal fin not elongate.

860. X. californiensis Steindachner.

Silvery, with continuous dusky stripes along the rows of scales on the upper half of the body, 3 above the lateral line, 4 or 5 below. Body oblong, not elevated nor much compressed; mouth moderate, terminal, very oblique, the lower jaw strongly protruding; premaxillary in front above the middle of the large eye; maxillary not very broad, reaching opposite front of pupil; eye $3\frac{1}{2}$ in head, longer than snout. Teeth in jaws villiform, in a very narrow band; on the vomer scarcely appreciable; edge of preopercle finely serrate; no opercular spine; ventrals with a large accessory scale; gill-rakers very long and slender; pseudobranchiæ large; scales small, firm, quite rough, covering the top of the head, cheeks, and most of the preorbital, which is rather narrow; soft parts of vertical fins well scaled; spinous dorsal depressible in a groove, the spines stiff; the two dorsals almost separate; second spine highest, the others regularly shorter; soft dorsal low; caudal forked; second and third anal spines high. Pectoral falcate, $\frac{3}{4}$ length of head, reaching beyond the tips of the rather short ventrals. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. IX–I, 12; A. III, 10; Lat. l. 52. Pacific coast, from San Diego southward. Here described from specimens collected by Dr. Streets at Cerros Island.

(Steindachner, Ichth. Beiträge, iii, 3, 1875; Streets, Bull. U. S. Nat. Mus. vii, 49.)

282.—LUTJANUS Bloch & Schneider.

Snappers.

(*Mesoprion* Cuvier: *Diacope* Cuvier: *Genyoroge* Cantor.)

(Bloch & Schneider, Systema Ichthyol. 1801, 324: type *Lutjanus lutjanus* Bl. & Schn.)

Body oblong, compressed, the back somewhat elevated; head long; mouth large, the jaws with bands of villiform teeth, besides which are

usually an outer series of larger teeth in each jaw, and 2–4 stronger teeth or canines in the front of the upper jaw; vomer with villiform teeth; villiform teeth on the palatines and in one or more patches on the tongue; preopercle sometimes with a notch posteriorly, into which a knob on the interopercle fits (*Diacope*); posterior limb of preopercle finely serrate; gill-rakers moderate, strong; branchiostegals 7; vertical fins not much scaly; dorsal spines 10–12; caudal lunate or forked. Vertebræ 10 + 14. Species very numerous, in all warm seas. (*Lutjang*, the Japanese or Malayan name of some of the species.)

a. Caudal fin deeply forked, the lobes attenuate. (*Ocyurus** Gill.)

861. L. melanurus (L.) J. & G.

Olivaceous, with oblique streaks above the lateral line, and some shining golden longitudinal bands on the side; no axillary spot nor lateral blotch; fins chiefly yellow, the caudal not black. Body elongate, compressed; head pointed; lower jaw prominent; upper canines well developed; preopercle without distinct notch; maxillary reaching to front of pupil; eye large, nearly as long as snout, $3\frac{1}{2}$ in head; top of head with a sharp keel; spines rather slender; pectorals reaching past tips of ventrals; anal spines graduated, short; caudal deeply forked, the inner rays less than half the length of the outer. Head 3; depth 3. D. X, 13; A. III, 9; Lat. l. 51. West Indies, north to Florida.

(*Perca melanura* L. Syst. Nat. (after Catesby): *Sparus chrysurus* Bloch, Ichth. taf. 262: *Mesoprion chrysurus* Cuv. & Val. ii, 459: *Mesoprion chrysurus* Günther, i, 186: *Ocyurus melanurus* Goode, Proc. U. S. Nat. Mus. 1879, 114.)

aa. Caudal fin lunate.

b. Vomerine teeth forming a cross-shaped or anchor-shaped patch; canines well developed. (*Lutjanus*.)

862. L. caxis (Bloch & Schn.) Poey.—*Yelting; Gray Snapper.*

Greenish olive, each scale with a brown spot, these sometimes confluent, forming narrow bands extending likewise across the vertical fins; usually a narrow blue stripe on preorbital and cheeks; young sometimes barred and with the fins dark-edged; no lateral blotch. Snout long and sharp; mouth moderate, maxillary reaching front of pupil; eye large, shorter than snout, $3\frac{1}{2}$ in head. Cheeks with about 6 rows of scales; preopercle with a slight notch at the tip of the interopercle; teeth strong; canines in upper jaw well developed; tongue with a sin-

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* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 236: type *Sparus chrysurus* Bloch. (ὠκύς, swift; οὐρά, tail.)

gle patch of teeth; nostrils oblong; gill-rakers shortish; spines strong; second anal spine little enlarged. Head 3; depth $2\frac{3}{4}$. D. X, 14; A. III, 8; Lat. l. 48. New York to South America; common southward.

(*Sparus caxis* Bloch & Schneider, 1801, 284: *Mesoprion griseus* Cuv. & Val. ii, 469: *Mesoprion griseus* Günther, i, 194: *Neomænis emarginatus* Girard, U. S. Mex. Bound. Surv. Ichth. 18; Poey, Rept. Fis.-Nat. Cuba, 1867, 269.)

863. L. blackfordi Goode & Bean.—*Red Snapper.*

Uniform rose-color; lighter below and on centres of scales; belly silvery; axil of pectoral dark. Body much compressed, lower profile much less arched than the upper. Preopercle finely serrated, the denticulations coarser at the angle; a slight emargination above the angle, in which is received a slight elevation on the interopercular bone. Maxillary reaching the orbit. Lingual teeth in two patches, the anterior cordate; canines strong, two in front of upper jaw larger than others. Anterior nostril round, posterior oblong. Pectorals elongate, reaching past the long ventrals nearly to anal. Third anal spine slenderer and slightly longer than the second. Caudal fin forked, the middle rays two-thirds as long as the external ones. Eye about 7 in head, two-thirds width of preorbital. Head $2\frac{5}{7}$; depth $2\frac{5}{7}$. D. X, 14; A. III, 9; L. lat. 50; L. transv. $\frac{8}{15}$. Coast of Florida; a large and beautiful species, becoming important as a food-fish.

(Goode & Bean, Proc. U. S. Nat. Mus. i, 176, 1878.)

864. L. stearnsi Goode & Bean.

Scarlet below, shading into reddish or purplish brown above; plum color on sides and top of head; below lateral line the posterior half of the exposed portion of the scales white tinted with scarlet; the basal portion reddish and much darker; lower side of head light scarlet; vertical fins darker than body; pectorals and ventrals white-roseate. Head 3 in length; depth 3. D. X, 14; A. III, 8; L. lat. 45; L. transv. $\frac{6}{14}$. (*Goode & Bean.*) Pensacola, Fla.

(Goode & Bean, Proc. U. S. Nat. Mus. i, 179, 1878.)

bb. Vomerine teeth in a diamond-shaped patch; canines feeble. (*Rhomboplites** Gill.)

865. L. aurorubens (Cuv. & Val.) Vaillant.—*Mangrove Snapper; Bastarp Snapper.*

Vermilion-red above, rosy below; sides with oblong irregular yellow spots; dorsal and pectoral fins red; ventrals and anal lighter. Body

*Gill, Proc. Acad. Nat. Sci. Phila. 1862, 237: type *Centropristis aurorubens* C. & V. (ῥομβος, rhomb; ὁπλιτης, armed; in allusion to the form of the patch of teeth on the vomer.)

oblong-elliptical, moderately compressed, not elevated. Mouth moderate, without distinct canines. Tongue with a large oval patch of teeth, besides which are 5 or 6 smaller patches. Nostrils round, near together. Preopercle finely serrate, its notch obsolete. Gill-rakers very long and slender. Dorsal spines rather slender; second anal spine a little longer than the third; caudal fin lunate, its lobes not attenuate. Head $3\frac{1}{2}$; depth 3. D. XII, 11; A. III, 8; Lat. l. 54. L. 1 foot. West Indies, north to South Carolina and Florida.

(*Centropristes aurorubens* Cuv. & Val. iii, 45: *Mesoprion aurorubens* Günther, i, 207: *Centropristes aurorubens* Storer, Mem. Am. Acad. Arts & Sci. 1846, 288: *Rhomboplites aurorubens* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 136.)

283.—POMADASYS Lacépède.

(*Pristipoma* Cuvier.)

(Lacépède, Hist. Nat. Poiss. iv, 515, 1802: type *Sciæna argentea* Forsk.)

Body oblong or ovate, somewhat compressed, the back elevated or not; mouth small, terminal, low; the maxillary usually not extending to opposite the eye, its tip not reaching the posterior edge of the broad preorbital; premaxillaries very protractile; teeth on jaws only, in villiform bands, the outer series usually more or less enlarged; a central groove behind the symphysis of the lower jaw; branchiostegals 7; cheeks and opercles scaly; preopercle rather finely and evenly serrate; scales moderate, few, if any, on the dorsal and anal fins; dorsal spines mostly 12, strong; gill-rakers feeble; caudal forked. Species numerous in all warm seas; the range of variation in form is very great in this genus. (πῶμα, operculum; δασυς, rough.)

a. Outer teeth considerably enlarged, canine.like. (*Conodon** C. & V.)

865. P. mobilis (L.) J. & G.

Body with 8 yellowish brown cross-bands; dorsal spines silvery. Form rather slender; the head conic, somewhat pointed, the lower jaw projecting; mouth moderate, low, oblique; a series of short, stout canines outside the usual band of villiform teeth; preopercle strongly serrate, with two spinous teeth at the angle, the teeth behind directed upward; chin with a central groove; pectorals narrow, not reaching as far as tips of ventrals, about to vent; second anal spine very long and strong, higher than the soft rays; caudal almost truncate. Air-bladder with

* Cuvier & Valenciennes, Hist. Nat. Poiss. v, 156: type *Conodon antillanus* C. & V. = *Sciæna plumieri* Bloch. (χονος, cone; ὀδων, tooth.)

two short horns in front. D. XII, 13; A. III, 7; scales 6–54–13. West Indies, north to Texas.

(*Perca nobilis* L. Syst. Nat.: *Sciæna plumieri* Bloch, Ichth. vi, 66, taf. 306: *Conodon plumieri* Günther, i, 304: *Conodon antillanus* Cuv. & Val. v, 156.)

aa. Outer teeth moderately enlarged, not canine-like.

b. Anal spines graduated. (*Orthopristis** Girard.)

867. P. fulvomaculatus (Mitchill) J. & G.—*Sailor's Choice; Hog-fish.*

Light brown, silvery below; sides with numerous orange-colored and yellow spots; those above the lateral line in oblique series, those below in horizontal rows; vertical fins with similar spots; head bluish, with yellow spots; angle of mouth and gill-membranes with orange. Body oblong, compressed, not much elevated. Head long. Snout conic. Mouth low and small, the maxillary barely reaching to the nostrils. Outer teeth slender and rather short. Eye high, $4\frac{1}{2}$ in head, nearly midway in its length, its diameter $\frac{2}{3}$ depth of the broad preorbital. Dorsal and anal entirely naked, with a sheath of scales at base; anterior spines of dorsal higher than the posterior, which are lower than the soft rays; anal spines short, graduated; pectoral moderate, reaching past tips of ventrals; caudal forked, the upper lobe the longer. Head $3\frac{1}{3}$; depth 3. D. XII, 16; A. III, 12; Lat. l. 75; pyloric cœca 6. L. 1 foot. Atlantic coast, from New York southward; a food-fish of some importance.

(*Labrus fulvomaculatus* Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 406, 1815: *Hæmulon fulvomaculatum* DeKay, New York Fauna, Fish. 84: *Pristipoma fulvomaculatum* Günther, i, 301: *Pristipoma fulvomaculatum* Holbrook, Ich. S. Car. 157.)

868. P. fasciatus (Cuv. & Val.) J. & G.

Sides with irregular dark cross-bars; a dark streak on the upper half of the operculum, extending on the sides; dorsal fin with two or three series of rounded brown spots. Eye 5 in head. Dorsal fin nearly even, its spines rather slender; caudal emarginate; third anal spine thinner and longer than the second. Head 3; depth 3. D. XII, 16; A. III, 13; Lat. l. 75; cœca 6. Gulf of Mexico, north to Louisiana. (*Günther.*)

(*Pristipoma fasciatum* Cuv. & Val. v, 285: *Pristipoma fasciatum* Günther, i, 301.)

bb. Second anal spine larger than third. (*Pomadasys.*)

869. P. davidsoni (Steindachner) J. & G.—*Sargo.*

Grayish silvery, dark above, with many dark points; a very distinct black cross-band on back and sides, from between the fifth and seventh

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* Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 15: type *Orthopristis duplex* Grd. = *Labrus fulvomaculatus* Mitch. (ὀρθός, erect; πρίστις, saw.)

dorsal spines to opposite the lower edge of the pectoral; edge of opercle and base of pectoral black; fins otherwise dull yellowish. Body ovate, compressed, much elevated; a regular and steep curve from snout to dorsal. Mouth small, terminal; maxillary not reaching front of eye. Preorbital about as wide as eye, which is 4 in head. Outer teeth distant, little enlarged. Gill-rakers moderate. Membranes of dorsal and anal somewhat scaly; dorsal fin deeply emarginate; second anal spine longer and stronger than third; pectoral long, reaching vent; caudal forked, the upper lobe the longer. Head $3\frac{2}{5}$; depth $2\frac{1}{2}$. D. XII, 14; A. III, 10; scales 10–56–22. L. 12 inches. Pacific coast, from Santa Barbara Islands southward.

(*Pristipoma davidsoni* Steindachner, Ichthyol. Beiträge, iii, 6, 1875.)

870. P. virginicus (Linn.) J. & G.

Golden olive above, silvery below, a dusky oblique bar running from nape forward through eye, and another running vertically downwards from beginning of dorsal; behind this are several narrow longitudinal stripes of bright light blue edged above and below with black. Body ovoid, compressed, and much elevated. Profile very steep. Mouth small, oblique; maxillary scarcely reaching front of orbit; outer teeth rather strong. Eyes rather large. Second anal spine very strong, longer than soft rays; pectoral long, reaching anal. Head $3\frac{1}{4}$; depth $2\frac{1}{4}$. D. XII, 17; A. III, 9. South Atlantic coast of United States to Lower California.

(*Sparus virginicus* Linn. Syst. Nat.: *Pristipoma virginicum* Günther, i, 288: *Anisotremus virginicus* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 106: *Anisotremus tæniatus* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 107.)

871. P. bilineatus (C. & V.) J. & G.

Body rather deep; snout obtuse, shorter than eye, which is one-third length of head; mouth narrow, the maxillary reaching front of eye; preopercle serrulate, the teeth at the angle stronger; dorsal spines strong, the third spine longest, half length of head; second anal spine extremely strong, much longer than dorsal spines; vertical fins scaly half their height; caudal emarginate. Two parallel brown bands on each side, one above the lateral line, the other from the eye to a brown spot at the root of the caudal; adults becoming uniform in color; fins blackish. Head $3\frac{2}{3}$ (in total, with caudal); depth $2\frac{2}{3}$. D. XII, 17; A. III, 8; scales 9–50–14. (*Günther.*) Tropical America, on both coasts, north to San Diego.

(*Pristipoma bilineatum* and *melanopterum* Cuv. & Val. v, 271, 273; *Pristipoma melanopterum* Günther, i, 287: *Pristipoma melanopterum* Steind. Ichth. Beitr. viii, 5, 1879.)

284.—DIABASIS Desmarest.

Red Mouths.

(*Hæmulon* Cuvier.)

(Desmarest, Première Decade Ichth. (1818): type *Diabasis parræ* Desm.)

Body oblong, usually more or less elevated; mouth wide, the maxillary very long, reaching usually to below the eye, its tip extending to the posterior end of the preorbital; no teeth on vomer or palatines; teeth of the jaws conical, the outer series stronger, curved; lips and inside of the mouth commonly bright red in life; soft parts of the vertical fins completely covered with scales; a marked angle formed at the junction of the spinous and soft parts of the dorsal; second anal spine enlarged, generally larger and longer than the third; caudal forked. Species very numerous. (*διάβασις*, a crossing; the allusion not evident.)

* Sides of the head with blue stripes.

872. D. formosus (L.) J. & G.—*Black Grunts.*

Brownish above, sides lighter; top and sides of head with very many (12 or more) narrow wavy longitudinal lines of dark blue, which do not extend on the trunk; 6 or more of them on preorbital; fins dusky, with a more or less apparent bluish tint; a red blotch at angle of mouth, extending forward on lower lip. Body oblong, compressed and elevated, highest at origin of dorsal fin; profile very convex to front of eye, where the long, compressed snout forms an angle with it. Eye posterior and high up; 2 in snout, 4 in head. Mouth large; maxillary reaching front of orbit. Snout with a few scattered scales. Second anal spine much enlarged. Head $2\frac{3}{4}$; depth $2\frac{2}{3}$. D. XII, 17; A. III, 9; Lat. l. 55. South Atlantic coast of the United States and southward.

(*Perca formosa* Linn. Syst. Nat.: *Hæmulon formosum* Günther i, 305: *Hæmulon arcuatum* Cuv. & Val. ix, 481: *Hæmulon arcuatum* Holbrook, Ich. S. C. 1860, 124.)

** Sides of head without blue stripes.

a. Body not striped.

873. D. chrysopterus (Linn.) J. & G.

Light brown above; sides brilliantly silvery; mouth red posteriorly, white in front. Body with general form of preceding, but the back less elevated, the profile being nearly straight. Scales of the pectoral region not larger than the others. Head $2\frac{3}{4}$; depth $2\frac{3}{4}$. D. XIII, 14; A. III, 10; Lat. l. about 55. (*Holbrook.*) West Indies, north to South Carolina.

(*Perca chrysoptera* Linn. Syst. Nat.: *Hæmulon chrysopterum* Günther, i, 313: *Hæmulon chrysopterum* Holbrook, Ich. S. C. 1860, 121.)

aa. Body striped or banded.

874. D. fremebundus (Goode & Bean) J. & G.

Pale, with a pair of bands as broad as the pupil extending from the snout, where they unite, following the dorsal line at a distance about equal to their own width, and connecting with the same at the end of the base of the second dorsal, where they reunite; a second broad pair of bands extending from the snout through the middle of the eye, in a straight line below the lateral line to the base of the caudal; traces on the head of a pair of narrower bands between the two other pairs; a single stripe on the mesial line of the body, from a point in advance of the eyes to the region of the dorsal; a very prominent blotch at base of caudal fin; maxillary extending beyond front of orbit; dorsal fin moderately notched, the fourth spine the longest; second anal spine very strong and longer than the fourth dorsal spine, also longer than the third anal spine; scales very large, irregularly arranged. Head 3; depth 3. D. XI, I, 15; A. III, 8; L. lat. 50; L. transv. $\frac{5}{10}$. (*Goode & Bean.*) Clear Water Harbor, Florida.

(*Hæmulon fremebundum* Goode & Bean, Proc. U. S. Nat. Mus. ii, 340, 1879.)

875. D. trivittatus (Bloch & Schn.) J. & G.—*White Grunt.*

Greenish olive, sides with about 4 distinct brownish or yellowish longitudinal streaks running up on sides of head; the two middle ones broader and golden, running from the eye and muzzle below the lateral line; lips and mouth brilliant red; dorsal and caudal fins grayish brown. Body rather elongate, fusiform, compressed and but little elevated; snout sharp; mouth moderate, somewhat oblique, the narrow maxillary reaching beyond front of orbit; eye as long as snout; second and third anal spines of nearly equal length, the second the stronger. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. XIII, 14; A. III, 8; Lat. l. 70. South Atlantic coast of United States and southward; well distinguished from the other American species by its slender form.

(*Grammistes trivittatus* Bloch & Schneider, 1801, 188: *Serranus capeuna* Licht. Berl. Abhandl. 1820, 288: *Hæmulon quadrilineatum* Günther, i, 316: *Hæmylum capeuna* Goode, Bull. U. S. Nat. Mus. v, 53.)

285.—LOBOTES Cuvier.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type *Lobotes erate* Cuvier = *Holocentrus surinamensis* Bloch.)

Body oblong, compressed and elevated, covered with moderate-sized, weakly ctenoid scales; profile of head concave, the snout prominent; mouth moderate, oblique, with thick lips; upper jaw very protractile, the lower the longer; jaws with narrow bands of villiform teeth, in

front of which is a row of larger conical teeth directed backward; no teeth on vomer or palatines; preorbital narrower than eye; preopercle strongly serrate. Branchiostegals 6. Dorsal fin continuous, with 12 spines which may be depressed in a shallow groove; soft rays of dorsal and anal fins elevated; anal spines graduated; bases of soft dorsal and anal thickened and scaly; caudal rounded. Air-bladder present. Pyloric cœca 3; vertebræ 13 + 11. (*λοβότες*, lobed; the soft parts of dorsal, anal, and caudal said to resemble one three-lobed fin.)

876. L. surinamensis (Bloch) Cuvier.—*Flasher.*

Blackish above, becoming silvery-gray on the sides; often blotched and tinged with yellow; fins dusky gray, sometimes with yellow. Head small. Profile from dorsal to occiput strongly convex, from occiput to snout concave; maxillary reaching beyond middle of orbit. Scales around eye very small, those on opercle large. Eye small, much shorter than snout. Pectorals shorter than ventrals, which do not reach vent; soft dorsal higher than the spinous portion. Head 3; depth $2\frac{1}{4}$. D. XII, 16; A. III, 11; L. lat. 47. A large fish, reaching a length of from 2 to 3 feet, and found in all warm seas; north on our coast to Cape Cod.

(*Holocentrus surinamensis* Bloch & Schneider, 1801, 316: *Lobotes auctorum* Günther, i, 338; Holbrook, Ich. S. C. 1860, 169.)

286.—SPARUS Linnæus.

(*Pagellus, Chrysophrys* and *Pagrus* Cuvier; *Calamus* Swainson.)

(Linnæus, Syst. Nat.: type *Sparus auratus* L.)

Body oblong or ovate, compressed, covered with moderate-sized scales. Head moderate. Opercles not armed. Cheeks scaly. Mouth rather small, terminal, low. Anterior teeth in the jaws cardiform, the outer series of teeth generally enlarged, sometimes canine-like, not compressed. Both jaws with two or more series of rounded molar teeth, which are sometimes irregularly mixed with slender teeth; no teeth on vomer or palatines. Dorsal rather low, the spines, 11–13 in number, depressible in a groove; anal spines moderate, the second not greatly developed. Caudal fin forked. Air-bladder simple. Gill-rakers short. Branchiostegals 6. Intestinal canal short. Pyloric cœca few. Carnivorous fishes, mostly of the Atlantic. (*σπάρος*, *Sparus*, the ancient name; from *σπαίρω*, to struggle.)

a. Anterior teeth not canine-like. (*Pagellus** C. & V.)

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*Cuvier & Valenciennes, Hist. Nat. Poiss. vi, 169, 1830: type *Sparus erythrinus* L. (From *pagel*, a French name of *Sparus erythrinus*.)

877. S. milneri (Goode & Bean) J. & G.

Dull silvery with brown cross-bands. Form of *Diplodus argyrops*. Diameter of eye equalling length of opercle; eye about 4 in head, less than $1\frac{1}{2}$ in snout. Preorbital nearly as high as long, with the edge nearly straight. Five series of scales between the preorbital and angle of preopercle. Three series of molars in the upper jaw, two in the lower; front teeth not described. Head $3\frac{1}{2}$; depth $2\frac{1}{4}$. D. XII, 12; A. III, 10; L. lat. 48; L. transv. $\frac{7}{14}$. (*Goode & Bean.*) Charlotte Harbor, Fla.

(*Pagellus milneri* Goode & Bean, Proc. U. S. Nat. Mus. ii, 134, 1879.)

aa. Anterior teeth canine-like.

b. Molar teeth above in two series. (*Pagrus** Cuvier.)

878. S. pagrus L.

Silvery; back rose-colored. Upper profile of the head parabolic; an obtuse prominence before the upper anterior angle of the eye; preorbital a third higher than long, with an incision in front. No procumbent dorsal spine. Dorsal spines not elongate; second anal spine stronger but not longer than the third, one-fourth the length of the head; pectoral elongate, reaching the fourth soft ray of the anal. Eye $1\frac{1}{3}$ in interorbital space; $1\frac{2}{3}$ in snout. Head 3; depth $2\frac{2}{3}$. D. XII, 10; A. III, 8; scales 6–56–16. Mediterranean Sea and neighboring waters; occasional on our South Atlantic and Gulf coasts.

(L. Syst. Nat.: *Sparus argenteus* Bloch & Schneider, 1801, 271: *Pagrus vulgaris* Günther, i, 466: *Pagrus argenteus* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 133.)

879. S. chrysops L.—*Porgee.*

Color nearly plain dull silvery; axil dusky; ventrals dark. Back elevated; head large and heavy; eye large, placed high; preorbital very large, its diameter half greater than that of eye; interorbital area very convex. Six strong conical teeth in front of upper jaw, and 8 in lower; about 2 rows of molars, the inner series larger. Five rows of scales on the widest part of the cheek, 4 on the interopercle; breast scales large. A procumbent spine before the dorsal; dorsal spines rather high; second and third anal spines about equal; caudal forked; pectoral long and falcate, reaching the last anal spine; ventrals moderate. Head 3; depth $2\frac{1}{6}$. D. XIII, 12; A. III, 11; Lat. l. 52. South Atlantic coast; abundant; long overlooked by naturalists, lately rediscovered by Mr. R. E. Earll.

(*Sparus chrysops* L. Syst. Nat.; Goode MSS.)

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*Cuvier, Règne Anim. ed. 2, 1817: type *Sparus pagrus* L. (πάγρος, the ancient name of the typical species.)

880. S. aculeatus (C. & V.) Gill.

Silvery; reddish on the sides, with golden longitudinal streaks; dorsal and anal fins reddish, ventrals red. Pectoral elongate. Limb of preopercle scaly. Molar teeth small, in two* series in the upper jaw. Body rather elongate. A procumbent spine before the dorsal. D. XII, 12; A. III, 12. (*Cuvier & Valenciennes.*) Atlantic coast of the United States, chiefly southward; rare; a doubtful species, perhaps the same as the preceding or the next.

(*Chrysophrys aculeata* Cuv. & Val. vi, 137: *Chrysophrys aculeatus* Günther, i, 496.)

287.—DIPLODUS Rafinesque.

(*Sargus* Cuvier, 1817; preoccupied in Entomology.)

(†Rafinesque, Indice Ittiologia Siciliana, 1810, 54: type *Sparus annularis* L.)

Body oblong or ovate, more or less compressed, the back often elevated. Mouth rather small, terminal, low. Incisors broad or narrow, truncate, entire or more or less emarginate, sometimes serrate in the young; a series of smaller teeth behind them. Molar teeth mostly in 2 or 3 rows. No teeth on vomer or palatines. Scales moderate. Dorsal spines mostly 12, strong, depressible in a groove. Procumbent dorsal spine present or absent; anal spines rather strong. Caudal fin forked. Gill-rakers short and slender. Branchiostegals 6. Intestinal canal short. Pyloric cœca few. Carnivorous species; abundant in the Atlantic, many of them highly valued as food. (διπλόος, double; ὀδοὺς, tooth; the teeth of two sorts.)

a. Incisor teeth very narrow, entire. (*Stenotomus*‡ Gill.)

881. D. argyrops (L.) J. & G.—*Scup; Scuppaug; Porgee.*

Brownish, somewhat silvery below, everywhere with bright reflections, but without distinct markings in the adult; soft parts of vertical fins somewhat mottled with dark; young faintly barred; axil dusky. Body ovate, compressed, the back elevated, the axis of the body near the middle of its depth. Head deep. Eye narrower than the preorbital. Mouth small, terminal, the maxillary extending to opposite the posterior nostrils. Incisor teeth very narrow, almost con-

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*In *three* series according to C. & V. The original type is now lost, but a memorandum by Aug. Duméril, preserved in the Museum at Paris, states that the specimen was a "*Pagrus*" (with two rows of molars), and not a "*Chrysophrys*" (with three).

†"VI. Gen. *Diplodus.* Una sola ala dorsale principando vicino al capo, un apendice squamosa vicino ad ogni ala toracina. *Osserv.* Contiene il *Sparus annularis* di Linneo, ed *Sp. variegatus* di Lacépède." (*Rafinesque.*)

‡Gill, Canadian Naturalist, August, 1865: type *Sparus argyrops* L. (στενός, narrow; τομος, cutting.)

ical; molars in two rows above. Cheeks short and deep with 4 rows of scales. A procumbent spine in front of the dorsal. Third dorsal spine elevated, often somewhat filamentous. Pectorals moderate, reaching front of anal, ventrals a little further; second anal spine a little the longest. Head $3\frac{1}{4}$; depth 2. D. XII, 12; A. III, 11. Scales 8–49–16; L. 12 inches. Cape Cod to Florida; abundant; a valuable food-fish.

(*Sparus argyrops* L. Syst. Nat.: *Pagrus argyrops* Cuv. & Val. vi, 164: *Pagrus argyrops* Holbrook, Ich. S. Car. 174: *Pagrus argyrops* Günther, i, 472: *Sargus ambassis* Günther, i, 449: *Stenotomus argyrops* Gill, and of most late American writers.)

aa. Incisor teeth broad.

b. Incisor teeth emarginate; procumbent dorsal spine present. (*Lagodon** Holbrook.)

882. D. rhomboides (L.) J. & G.—*Pin-fish; Bream.*

Brownish, white below; sides of head and body with horizontal stripes of light blue and golden; 6 or 7 very faint darker vertical bands, disappearing with age; vertical fins yellowish, with bluish stripes; a dark axillary spot. Body ovate, elliptical, compressed, and somewhat elevated, the axis of the body near the middle of its depth; snout about in the axis. Head rather sharp. Mouth small, the upper jaw more freely protractile than usual. Molars in two series; anterior incisors each deeply notched. Cheeks with 5 or 6 rows of scales; scales on breast little reduced in size. A procumbent spine before the dorsal fin; dorsal spines high, much higher than the soft rays, the fourth highest; second anal spine little larger or longer than the third; pectorals as long as head; ventrals moderate. Head $3\frac{1}{2}$; depth $2\frac{1}{3}$. D. XII, 11; A. III, 11; scales 8–66–18. L. 1[illegible] inches. New Jersey to Texas; abundant southward.

(*Sparus rhomboides* Linn. Syst. Nat.: *Sargus rhomboides* Cuv. & Val. vi, 68: *Sargus rhomboides* Günther, i, 447: *Lagodon rhomboides* Holbrook, Ich. S. Car. 1860, 59.)

aa. Incisors entire in the adult; emarginate or serrate in the young.

b. A procumbent spine before the dorsal fin. (*Archosargus*† Gill.)

883. D. probatocephalus (Walb.) J. & G.—*Sheepshead.*

Grayish, with about 8 vertical black bands, which are about as broad as the interspaces; dorsal dusky; ventral and anal black; base of pectoral dusky. Body robust, becoming very deep with age, the back compressed and elevated; axis of the body below the middle of the depth; snout entirely below axis of body; profile very steep;

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*Holbrook, Ich. S. Car. ed. i, 56, 1859: type *Sparus rhomboides* L. (λαγως, hare; ωδων, tooth.)

†Gill, Canadian Naturalist, August, 1865: type *Sparus probatocephalus* Walb. (ἄρχον, ruler; σάργος, Sargus, from its preëminence in size and value.)

preorbital broad. Mouth low, horizontal; incisors broad, serrated in the young, then becoming emarginate and finally entire. Cheeks with 6 rows of scales; scales on breast very small, crowded. Dorsal spines very strong, higher than the soft rays, the last considerably shortened, so that the outline of the fin is emarginate; second anal spine very strong, nearly as long as the snout and eye; pectoral very long, reaching past the front of the anal; ventrals reaching vent. Head $3\frac{1}{4}$; depth $1\frac{2}{3}$. D. XII, 12; A. III, 10; scales 7–45–16. L. 30 inches. Cape Cod to Texas; abundant; the largest member of the genus, and one of our most valued food-fishes.

(*Sparus probatocephalus* Walbaum, Artedi, Pisc. 1792, 295: *Sargus ovis* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 392, 1814: *Sargus ovis* Cuv. & Val. vi, 53: *Sargus ovis* Holbrook, Ich. S. Car. 1860, 54; Günther, i, 447: *Archosargus probatocephalus* Gill, and of most late American writers.)

bb. No procumbent spine before the dorsal fin. (*Diplodus.*)

881. D. holbrooki (Bean) J. & G.—*Bream.*

Dull silvery, without cross-bands; dorsal, caudal, anal, ventrals, axil, and edge of opercle dusky; a black blotch on caudal peduncle above. Body ovate, not elevated, compressed, the axis of the body below the middle of its depth. Eight incisors in each jaw; three rows of molars above, two below. Pectoral 3 in length; second anal spine longest. Head $3\frac{4}{5}$; depth $2\frac{1}{2}$. D. XII, 14; A. III, 13; scales 8–61–16. L. 12 inches. Charleston, S. C. (*Bean.*) (Possibly the adult form of the next.)

(*Sargus holbrooki* Bean, Forest and Stream, June 13, 1878, and in Proc. U. S. Nat. Mus. 1878, 198.)

885. D. caudimacula (Poey) J. & G.—*Spot-tailed Pin-fish.*

Silvery, with bright reflections; about 8 very narrow dark vertical bands; a very distinct black bar on back and sides of caudal peduncle; shining streaks and dark punctulations along the rows of scales; ventrals and anal mottled with dusky; edge of opercle dusky; axil dark. Body ovate, compressed, very deep. Dorsal and ventral outlines both strongly arched, the axis of the body at about the middle of the depth, the back steeply elevated behind the nape. Maxillary not reaching the eye, which is 3 in head. Caudal peduncle short and slender, about as deep as long. Cheeks with 3 rows of scales; interopercle broad, with 3 distinct rows of scales; scales on breast not much reduced. Mouth very small, terminal. Incisors broad, entire. Spines moderate, those of the dorsal higher than the soft rays; second anal spine longest; pectorals long, reaching to anal; ventrals reaching to vent. Head $3\frac{1}{3}$;

depth 2. D. XII, 14; A. III, 13; scales 6–63–14. L. 5 inches. North Carolina to Cuba; abundant at Beaufort, N. C.

(*Sargus caudimacula* Poey, Memorias, ii, 198, 1858: *Sargus holbrooki* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 379; not of Bean.)

288.—GIRELLA Gray.

(*Camarina* Ayres.)

(Gray, Illustr. Ind. Zoöl. 1838: type *Girella punctata* Gray.)

Body oblong-ovate, compressed, covered with rather large scales. Mouth small, with a series of flat, tricuspid, movable incisors, behind which is a broad band of similar smaller ones; no molar teeth; no teeth on vomer or tongue. Cheeks with very small scales; opercles and top of head chiefly naked. Dorsal fin rather low, with about 14 spines, on the bases of which the scales extend, forming an imperfect sheath; no groove at base of dorsal; no procumbent dorsal spine; anal spines small, graduated; caudal lunate. Air-bladder divided into two posterior horns. Pyloric cœca numerous; intestinal canal elongate; peritoneum black. Herbivorous. Pacific Ocean. (A latinization of the French "*Girelle*"=*Julis*.)

886. G. nigricans (Ayres) Gill.—*Blue-fish.*

Dusky green, paler below; young with a large yellowish spot on each side of the dorsal fin. Body oval, compressed, with very deep caudal peduncle; snout thick, its profile evenly rounded; mouth small, subinferior, low, nearly horizontal; maxillary reaching nearly to front of orbit; a minute patch of palatine teeth; preopercle minutely serrulate at its angle; preorbital as broad as eye. Gill-rakers numerous, rather long. Scales firm, weakly ctenoid, those on thorax and front of back smaller. Dorsal spines lower than the soft rays; anal higher than soft dorsal, similar to it; caudal emarginate; pectorals short and broad, not reaching vent; ventrals short. Head 4; depth $2\frac{1}{2}$. D. XIV, 14; A. III, 12; Lat. l. 50. L. 12 inches. Coast of California, from Monterey southward, abundant in rocky places, feeding on sea-weed.

(*Camarina nigricans* Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 81: *Girella dorsomacula* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 244.)

289.—PIMELEPTERUS Lacépède.

(Lacépède, Hist. Nat. Poiss. iv, 429, 1802: type *Pimelepterus bosci*, Lacépède.)

Body regularly ovate, moderately compressed; head short, with blunt snout; eye large; mouth small, horizontal; maxillary barely reaching front of eye; both jaws with a single series of rather narrow

obtusely lanceolate incisors, implanted with compressed usually conspicuous roots posteriorly; behind these a narrow band of villiform teeth; fine teeth on vomer, palatines, and tongue. Branchiostegals 7; gill-rakers long. Preopercle obsoletely serrate; preorbital narrow, covering but little of the maxillary. Squamation very complete, the space between and about the eyes being the only naked part; scales smallish, thick, ctenoid, 60–70 in the lateral line, which is continuous; similar scales entirely covering the soft parts of the vertical fins, and extending up on the paired fins. Dorsal fin low, with about 11 spines, which are depressible in a groove of scales; the fin continuous, but the last spines low, so that a depression occurs between the two parts of the fin; the bases of the spinous and soft parts about equal; anal similar to soft dorsal, with 3 spines; caudal fin forked; pectoral fins small; ventrals well behind them. Intestinal canal long. Pyloric cœca usually very numerous. Species numerous, in all warm seas. Herbivorous. (*πιμελὴς*, fat; *πτερὸν*, fin.)

a. Soft dorsal and anal not elevated, the latter rather short. (*Pimelepterus.*)

887. P. bosci Lac.

Dusky, with series of light stripes, about 25 in number, following the rows of scales; the middle part of each scale pale, the edge dusky; the stripes along middle of body much broader than the others, the scales along the back and belly being much smaller; a silvery streak along the preorbital. Body ovate, somewhat compressed. Longest dorsal spine one-fifth the height of the body, rather higher than the soft dorsal and nearly equal to the longest ray of the anal. Horizontal process of the teeth not much longer than the vertical. Interorbital space $2\frac{1}{2}$ in head; top and sides of head finely scaled; interorbital region gibbous, below which point the snout is truncate; preopercle weakly serrulate; gill-rakers long. Soft dorsal and anal very low; median dorsal spines highest; second anal spine highest; caudal well forked, the lower lobe longest. Head $4\frac{1}{5}$; depth $2\frac{1}{3}$. D. XII, 12; A. III, 11; scales 10–66–20; vertebræ 9 + 16. Massachusetts to Panama; common southward.

(? *Perca sectatrix* L. Syst. Nat.: *Pimelepterus bosci* Lacépède, Hist. Nat. Poiss. iv, 429, 1802: *P. bosci* Cuv. & Val. vii, 258: *P. bosci* Günther, i, 497: *Pimelepterus flavolineatus* Poey, Repert. i, 319; Poey, Synopsis Pisc. Cubens. 324, 1868.)

290.—SCORPIS Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poiss. viii, 503, 1831: type *Scorpis georgianus* Cuv. & Val.)

Body ovate or suborbicular, covered with small, firm, ctenoid scales, which also cover the membranes of the soft parts of the vertical fins; mouth small, terminal, horizontal; the maxillary narrow, slipping under the edge of the rather narrow preorbital; sides, top of head and jaws closely scaled; preopercle entire or minutely crenulate; jaws with broad bands of slender teeth; those in the outer series incisor-like,* compressed, narrow and lanceolate in form, the outer surface transversely convex, the inner concave; the other teeth of the jaws are similar, but grow progressively smaller backward toward the inside of the mouth; incisors without conspicuous roots behind; all the teeth are somewhat movable, as in *Girella;* no molar teeth; vomer, palatines, and tongue with patches of minute villiform teeth; gill-rakers slender, rather long; dorsal spines low, in a slight groove, about 10 in number; soft part of the fin elongate, much longer than the spinous part, sometimes falcate; anal spines small, graduated, the soft rays numerous; caudal lunate; scales thinnish, adherent, with smaller ones intermixed; pyloric cœca extremely numerous; air-bladder small; branchiostegals 7. Warm seas. (*σκορπις*, name of some sea-fish; from *σκορπιος*, scorpion.)

a. Body ovate; fins not falcate. (*Cæsiosoma* Kaup †)

888. S. californiensis Steindachner.—*Medialuna.*

Blackish above, tinged with bluish; steel-blue or grayish below, somewhat mottled; sides with faint oblique vertical lines of spots; fins blackish. Body elliptic-ovate, its outlines regular; head bluntish, rounded, strongly convex; maxillary not reaching front of eye; eye small, $1\frac{1}{3}$ in snout, 5 in head; middle spines of dorsal highest, their height scarcely greater than the diameter of the eye; soft dorsal low, not elevated in front, little higher than the spines; anal low; caudal lunate, the upper lobe slightly longer; pectorals short and narrow; ventrals rather small. Head $3\frac{2}{3}$; depth $2\frac{1}{4}$. D. IX, I, 22; A. III, 19; scales 9–58–19. L. 12 inches. Coast of California, from Point Concepcion southward; a handsome fish, of considerable value as food.

(Steindachner, Ichthyol. Beiträge, iii, 19, 1875.)

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* In *Scorpis georgianus*, the type of the genus, the outer teeth are said to be conic. This is probably erroneous, otherwise our species does not belong to the genus.

† Kaup; Bleeker, Systema Percarum ii, 11, 1875: type *Scorpis æquipinnis* Rich.

Family LXXXIX.—APOGONIDÆ.

Body oblong, elevated, covered with usually large, loose, deciduous scales, which are striated and ctenoid or sometimes cycloid; cheeks scaly; lateral line continuous; cleft of mouth wide, oblique; villiform teeth on jaws and vomer; canines sometimes present; preopercle commonly with a double ridge, its edge entire or slightly serrated; lower pharyngeals separate, with sharp teeth; pseudobranchiæ present; branchiostegals 6 or 7. Dorsal fins well separated, the first with 6 or 7 rather strong spines; anal fin short, usually with 2 spines; ventral fins thoracic, I, 5. Fishes mostly of the Eastern seas, some of them in fresh waters. Genera about 10; species about 120.

(*Percidæ* part: group *Apogonina* Günther, i, 222–250.)

a. Branchiostegals 7; no canines; no recumbent dorsal spine; palatine teeth present; anal spines 2. (*Apogoninæ.*)

b. Lateral line commencing at the head; preopercle with a double ridge; teeth on the palatines.....Apogon, 291.

291.—APOGON Lacépède.

King of the Mullets.

(*Amia* Gronow, not of Linnæus.)

(Lacépède, Hist. Nat. Poiss. iii, 411, 1802: type *Apogon ruber* Lac. = *Mullus imberbis* L. = *Apogon rex-mullorum* C. & V.)

Body oblong, compressed, covered with very large ctenoid scales. Lateral line continuous. Head large; mouth wide, oblique, the maxillary extending to below the middle of the large eye; villiform teeth on jaws, vomer, and palatines; no canine teeth; preopercle with a double ridge, entire or somewhat serrate; opercle with a spine behind. Gill-rakers rather long. Dorsal spines 6 or 7, strong; second dorsal remote, short; anal with 2 spines, the second much the longer, the soft part similar to the soft dorsal; pectorals and ventrals moderate. (ἀπώγων, without beard; thus distinguished from the bearded mullet, *Mullus.*)

a. Edges of preopercle serrulate; scales very large. (*Apogon.*)

889. A. americanus Castelnau.

Violaceous, scales all with dark points; a dark spot on opercle. Body comparatively elongate, little elevated; jaws equal; muzzle short; eye large, $3\frac{1}{5}$ in head; preopercle very finely denticulated. Second dorsal spine stoutest, as high as the third; pectorals nearly reaching anal.

Depth 3 in total. Head 3½. D. VI–I, 9; A. II, 8; scales 3–25–9. (*Vaillant & Bocourt.*) West Indies; accidental at Newport.

(Castelnau, Anim. Nouv. Rares Amér. du Sud, Poiss. 3; Vaillant & Bocourt, Miss. Sci. au Mex. 41: *Apogonichthys americanus* Günther, i, 247.)

aa. Edge of preopercle entire; scales comparatively small. (*Glossamia** Gill.)

890. A. pandionis Goode & Bean.

Color nearly plain reddish, the body and fins everywhere speckled with fine dots. Body oblong, not elevated nor greatly compressed. Eye very large, forming nearly half the length of the side of the head, much greater than the interorbital space; maxillary extending to opposite pupil; preopercle entire. Gill-rakers very long and slender. Mouth oblique, but not nearly vertical, the lower jaw projecting. Fins low; caudal well forked. Head 4; depth 4. D. VII–I, 9; A. II, 9; scales small, cycloid, 3–45–8. Deep water, off Chesapeake Bay.

(Goode & Bean, Proc. U. S. Nat. Mus. 1881, 160.)

Family XC.—MULLIDÆ.

(*The Surmullets.*)

Body elongate, slightly compressed, covered with large ctenoïd scales; lateral line continuous; large scales on the head; upper profile of the head more or less parabolic. Mouth small; teeth present in one jaw at least, and sometimes in both, or on the vomer or palatines. Premaxillaries protractile; maxillaries without supplemental bone, partly hidden by the broad preorbital. Eye moderate, placed high; branchiostegals 4; 2 long barbels at the throat, attached just behind the symphysis of the lower jaw. Dorsal fins 2, remote from each other, the first of several high spines, which are depressible in a groove; anal similar to the soft dorsal, with 1 or 2 small spines; ventrals thoracic, I, 5. Genera 5; species 35, in all tropical seas, some species straying northward.

(*Mullidæ* Günther, i, 397–411.)

* Teeth in lower jaw, and on vomer and palatines; none in the upper jaw. MULLUS, 292.
** Teeth in both jaws; none on vomer or palatines ..... UPENEUS, 293.

292.—MULLUS Linnæus.

Surmullets.

(Linnæus, Syst. Naturæ: type *Mullus barbatus* L.)

Teeth in the lower jaw and on the vomer and palatines; none in the upper jaw; dorsal spines 7; anal spines very small. Otherwise as in

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* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 82: type *Apogon aprion* Rich. (γλῶσσα, tongue; αμια, *Amia*, a name applied by Gronow to *Apogon*.)

Upeneus, the head rather shorter. One species known. (Latin, *mullus*, the ancient name of *Mullus barbatus*, from μύλλος, lip; hence "mullet," a fish with thick lips.)

891. M. barbatus L.—*Surmullet.*

Red, with three yellow longitudinal stripes. Body oblong, moderately compressed; snout blunt, its profile very obliquely decurved; mouth horizontal, small; maxillary scarcely reaching front of orbit; diamter of eyes about equalling the slightly concave interorbital space. Head $3\frac{1}{2}$; depth $3\frac{2}{3}$. D. VII–I, 9; A. II, 6; Lat. l. 36, its mucous tubes branching into a network on each scale. European; this or some similar species said to have been once taken at New York (*Gill*). One of the choicest food-fishes of the Mediterranean.

(Linn. Syst. Nat.: *Mullus barbatus* and *surmuletus* Günther, i, 401: *Mullus*, sp. incog. Gill, Rept. U. S. Fish Com. 1872–3, 804.)

293.—UPENEUS Cuvier.

Goat Fishes.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type *Mullus barberinus* Lac.)

Body oblong, compressed; mouth moderate, nearly horizontal, low, the jaws subequal; eye large, high, posterior; opercle short, deep, with a posterior spine; jaws with rather strong teeth, in one series, or in a narrow band; no teeth on vomer or palatines; lips well developed; barbels nearly as long as head; scales very large, somewhat ctenoid; lateral line continuous, its tubes ramifying on each scale; head covered with large scales; first dorsal with about 7 spines; anal with 2, the first very short; caudal fin forked. Species numerous in the tropical seas. (An old name of some fish; from ὑπήνη, upper lip.)

a. Teeth in the upper jaw in more than one series. (*Pseudupeneus** Bleeker.)

892. U. maculatus (Bloch) Cuv. & Val.—*Goat Fish.*

Red; sides of head with bluish longitudinal lines; three black blotches along the lateral line; each scale with a blue spot at its base; body oblong, moderately compressed, tapering backwards from occiput; ventral outline nearly straight; snout long and rather sharp; mouth terminal, small; maxillary not reaching orbit; eyes situated backwards and high up; head $3\frac{1}{4}$; depth 4. D. VII–I, 8; A. II, 6; Lat. l. 30, high up and following the curve of the back. V. 10 + 14. West Indies; occasional on our coast.

(*Mullus maculatus* Bloch, Ichthyol, 1797, taf. 348; Günther, i, 408; *Mullhypeneus maculatus* Poey, Synopsis, 1868, 307: *Hypeneus maculatus* Goode, Bull. U. S. Nat. Mus. v, 49.)

**Pseudupeneus* Bleeker, Poiss. Côte Guinée, 1862, 56: type *Upeneus prayensis* Cuv. & Val. (ψεῦδος, false; *Upeneus*)=*Mullhypeneus* Poey, 1868.

Family XCI.—SCIÆNIDÆ.

(*The Croakers.*)

Body compressed, more or less elongate, covered with rather thin, ctenoid scales. Lateral line continuous, extending on the caudal fin. Head prominent, covered with scales. Bones of the skull cavernous, the muciferous system highly developed, the surface of the skull, when the flesh is removed, very uneven. Chin usually with pores, sometimes with barbels. Mouth small or large, the teeth in one or more series, the outer of which are sometimes enlarged; canines often present. No incisor nor molar teeth; no teeth on vomer, palatines, pterygoids, nor tongue. Maxillary without supplemental bone, slipping under the free edge of the preorbital. Premaxillaries protractile, but not very freely movable. Nostrils double. Pseudobranchiæ usually large, present in all our genera. Gills 4, a slit behind the fourth. Gill-rakers present. Branchiostegals 7. Gill-membranes separate, free from the isthmus. Lower pharyngeals separate or united. Preopercle serrate or not. Opercle usually ending in two flat points. Dorsal fin deeply notched, or divided into two fins, the soft dorsal being the longer, the spines depressible into a more or less perfect groove. Anal fin with 1 or 2 spines. Ventral fins thoracic, I, 5. Pectoral fins normal. Caudal fin usually not forked. Ear-bones very large. Pyloric cœca usually rather few. Air-bladder usually large and complicated (wanting in *Menticirrus*). Most of the species make a peculiar noise, called variously croaking, grunting, drumming, and snoring. This sound is supposed to be caused by forcing the air from the air-bladder into one of the lateral horns. Carnivorous. An important family of about 25 genera and 125 species, found in all warm seas, one species being confined to fresh waters. Many of them reach a large size, and nearly all are valued for food.

(*Sciænidæ* Günther, ii, 265–318.)

* Dorsals contiguous, the second dorsal much larger than the anal.

† Vertebræ about 10 + 14. (*Sciæninæ.*)

‡ Lower jaw included.

§ Lower pharyngeals fully united, with paved teeth; second anal spine very large.

a. Lower jaw without barbels. (Fresh-water species).—Haploidonotus, 294.

aa. Lower jaw with several small barbels. (Marine species).—Pogonias, 295.

§§ Lower pharyngeal bones distinct.

b. Lower jaw without barbels; anal spines 2.

c. Teeth well developed, persistent in both jaws.....Sciæna, 296.

cc. Teeth feeble, permanent in upper jaw only; anal spines small. LIOSTOMUS, 297.

bb. Lower jaw with several minute barbels.

d. Preopercle with its membranaceous margin crenulate. GENYONEMUS, 298.

dd. Preopercle with its bony margin serrate..... ....MICROPOGON, 299.

bbb. Lower jaw with a single thickish barbel.

e. Air-bladder present; anal spines 2.....UMBRINA, 300.

ee. Air-bladder none; anal spine single.....MENTICIRRUS, 301.

‡‡ Lower jaw projecting beyond upper.

f. Snout short, blunt; no canines; anal fin very smal; soft part of dorsal much longer than spinous part.....LARIMUS, 302.

††. Vertebræ about 14 + 10; body elongate; lower jaw projecting. (*Otolithinæ.*)

h. Canine teeth none.....ATRACTOSCION, 303.

hh. Canines two (or one) in upper jaw only.....CYNOSCION, 304.

** Dorsals remote; the second about as large as the anal. (*Isopisthinæ.*)

i. Lower jaw projecting; anal spines feeble; teeth small, sharp, in narrow bands.....SERIPHUS, 305.

294.—HAPLOIDONOTUS Rafinesque.

Fresh-water Drums.

(*Amblodon* Rafinesque.)

(*Aplodinotus* Rafinesque, Journ. de Phys. 1819, 418: type *Aplodinotus grunniens* Raf.)

Body oblong, the snout blunt, the back elevated and compressed. Mouth rather small, low, horizontal, the lower jaw included. Teeth in villiform bands, the outer scarcely enlarged. No barbels. Pseudobranchiæ rather small; gill-rakers short and blunt. Lower pharyngeals very large, fully united, with coarse, blunt, paved teeth. Preopercle slightly serrate. Dorsal spines strong and high, with a close fitting scaly sheath at base, the two dorsals somewhat connected. Second anal spine very strong. Caudal double-truncate. Fresh waters of the United States. (ἁπλοις, a cloak; νῶτος, back; according to Gill, from the scaly base of the dorsal fin.)

893. H. grunniens Raf.—*Sheepshead; Thunder-pumper; Drum; White Perch; Croaker.*

Grayish silvery, dusky above, sometimes quite dark, the back sometimes with oblique dusky streaks along the rows of scales. Scales rather thin, adherent, smaller on the back and belly. Second anal spine more than half the length of the head. Snout very blunt, overlapping the mouth. Eye large. Head $3\frac{1}{2}$; depth nearly 3. D. IX–I, 30; A. II, 7; Lat. l. 55. Great Lakes to Texas, abundant, reaching a weight of 50 to

60 pounds. Its flesh is not of high quality, and is often tough and ill-flavored, especially in the lakes.

(*Aplodinotus grunniens* Raf. Journ. de Phys. 1819, 88: *Corvina oscula* Günther, ii, 297: *Sciæna grisea* Le Sueur, Journ. Acad. Nat. Sci. Phila. 1822, 254: *Amblodon concinnus* and *lineatus* Agassiz, Am. Journ. Sci. Arts, 1855, 307: ? *Corvina richardsoni** Cuv. & Val. v, 100: *Amblodon neglectus* Grd. Mex. Bound. Surv. Ichth. 1859, 12.)

295.—POGONIAS Lacépède.

Drums.

(Lacépède, Hist. Nat. Poiss. iii, 138, 1802: type *Pogonias fasciatus* Lac. = *Labrus cromis* L.)

Body short and deep, the dorsal outline much elevated, the ventral nearly straight. Mouth moderate, the upper jaw longest; teeth small, in villiform bands, the outer not enlarged; lower pharyngeal bones large, fully united, armed with strong paved teeth; lower jaw with numerous barbels, each about half as long as the eye; preoperculum entire, with a membranaceous edge. Dorsal fins slightly connected, the spines high and strong; caudal fin subtruncate; first anal spine short, the second exceedingly large, nearly as long as the soft rays; pectorals and ventrals long; gill-rakers short and bluntish. Pseudobranchiæ large. Marine species reaching a very large size; among the largest of the Sciænidæ. (πώγωνίας, bearded.)

894. P. chromis (Linn.) C. & V.—*Drum.*

Grayish silvery, with 4 or 5 broad dark vertical bars, which disappear with age; fins dusky. Body oblong, much compressed;

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* If correctly described, this species is the type of a distinct genus which has been provisionally termed *Eutychelithus*. It is probable, however, that the type was a deformed individual of *H. grunniens*.

The following are the alleged characters, generic and specific:

EUTYCHELITHUS Jordan.

(Jordan, Man. Vert. E. U. S. ed. 1, 242, 1876: type *Corvina richardsoni* C. & V.)

Differs from *Haploidonotus* in the much deeper body, steep profile, the nearly equal jaws, the single rather short anal spine, and in the smaller size of most of the fins. (ἐυτυχής, lucky; λιθος, stone; in allusion to the large ear-bones of Sciænoid fishes. The ear-bones of *Haploidonotus* are quite large and are marked with a rude impress of the letter L, and are hence known to Wisconsin boys as "lucky-stones.")

E. richardsoni (C. & V.) Jordan.—*Maleshaganay.*

Grayish olive, with darker bands across the back; body much elevated, highest in front of dorsal fin; profile very abruptly decurved. Preopercle finely serrate. Eye half length of snout. Pectorals pointed, considerably longer than ventrals. Head $3\frac{1}{2}$ in total length, including caudal fin; depth $2\frac{3}{4}$. D. IX, 29; A. I, 7; Lat. l. 54. (C. & V.) Lake Huron.

(*Corvina richardsonii* Cuv. & Val. v, 100: *Corvina richardsonii* Richardson, Fauna Bor.-Amer. 1836, 64: *Corvina richardsonii* Günther, ii, 298.)

profile very steep, its curve uneven; ventral outline little curved. Mouth moderate, maxillary scarcely reaching middle of orbit. Scales large, those on breast much smaller. Fins large, pectorals reaching beyond tips of ventrals, nearly to vent; second anal spine more than half length of head. Head above scaly, except a triangular space on snout. Head $3\frac{1}{3}$ in length; depth $2\frac{1}{2}$. D. X, I, 20; A. II, 6; Lat. l. 50. Cape Cod to West Indies; abundant southward.

(*Labrus cromis* Linn. Syst. Nat.; Günther, ii, 270; Holbrook, Ich. S. Car. 1860, 114: *Pogonias fasciatus* Holbrook, Ich. S. Car. 1860, 119: *Pogonias fasciatus* Günther, ii, 270.)

296.—SCIÆNA Linnæus.

(*Johnius* Bloch: *Corvina* C. & V.: *Pseudosciæna* Bleeker.)

(Artedi; Linnæus, Syst. Nat.: type *Sciæna umbra* L.)

Body elongate, compressed, not much elevated. Head rather long. Mouth moderate or rather large, the lower jaw included. Teeth in both jaws mostly in villiform bands, the outer row often enlarged; lower pharyngeals separate, their teeth conic or paved. Chin with pores; no barbels. Preopercle with its bony posterior edge serrated, or else with a membranaceous margin. Scales moderate, in oblique series. Dorsal fins connected, the spines rather strong. Anal spines 2, the second varying in size. In this genus and most of the other *Sciæninæ* the muzzle above the premaxillaries is provided with a number of pores, and near the base of the premaxillary 2 or 4 small dermal flaps are present; in all these species the preorbital is very wide, and often gibbous. Species numerous, in all warm seas. Many attempts have been made to subdivide this genus, but none of the current genera form definable natural groups, when foreign species are taken into account. (*σκίαινα*, Sciæna, from *σκιά*, shade, the classical name of *Sciæna aquila*.)

a. Teeth in both jaws in single series or very narrow bands.

b. Head depressed, very broad between the eyes. (*Stelliferus** Stark.)

895. S. stellifera (Bloch) J. & G.

Pale above, with purplish reflections, almost translucent; below silvery; everywhere finely punctulate; fins yellowish, the tips of dorsal and pectoral blackish. Body oblong, not much elevated, little compressed; the tail slender; head short; snout blunt; eye very small, 5 in head; profile depressed above the eyes; the interorbital space flattish, extremely broad; a slight ridge above each orbit, these meeting

* Stark, Elements Nat. Hist. i, 459, 1828: type *Bodianus stellifer* Bloch.

above the snout. Mouth oblique, the lower jaw scarcely shorter than the upper; the maxillary extending to below the middle of the small eye. Teeth as in *S. punctata*, but with series of larger teeth less developed and the villiform band broader. Preorbital full, cavernous; preopercle cavernous, its margin with a few strong teeth. Pseudobranchiæ well developed. Gill-rakers long and slender. Dorsal spines slender; caudal strongly convex; second anal spine rather long, slender, nearly as long as soft rays. Ventral outline nearly straight. Vent a little nearer preopercular margin than base of caudal. Pectorals short, not reaching tips of ventrals. Head $3\frac{1}{4}$ in length; depth 3. D. XI, I, 22; A. II, 9; Lat. l. 50. West Indies, north to Virginia. Here described from a specimen from Pensacola.

(*Bodianus stellifer* Bloch, Ichth. taf. 231: *Cheilodipterus acoupa* Lacépède, iii, 546: *Corvina trispinosa* Cuv. & Val. v, 109: *Homoprion lanceolatus* Holb. Ich. S. Car. 1860, 167: *Sciæna lanceolata* Günther, ii, 289: *Stelliferus lanceolatus* Gill, Report U. S. Fish Comm. 1872–73, 805: ? *Corvina stellifera* Günther, ii, 299 = *Corvina microps* Steind. Ichth. Notiz. i, 6, 1864, said to be distinguished from *S. stellifera* by the smaller eye (6 in head), narrower interorbital space ($2\frac{1}{2}$ in head) and weaker serræ on the preopercle. Perhaps more than one species is here included.)

b. Head normal, narrow between the eyes. (*Bairdiella** Gill.)

896. S. punctata (Linn.) J. & G.—*Silver Perch; Yellow-tail; Mademoiselle.*

Greenish above, silvery below, each scale with a series of dark punctulations through the centre, usually very conspicuous, sometimes obscure, these forming narrow somewhat irregular streaks along the sides; fins plain, the caudal yellowish. Body oblong, compressed, rather robust. Head compressed, conical, not specially depressed, nor broadened; preoperculum scarcely cavernous, strongly serrated or spinous at its angle; interorbital region depressed, transversely convex, narrower than eye. Mouth rather large. somewhat oblique, maxillary reaching about to middle of orbit; jaws subequal; both jaws with stout recurved teeth, behind which in the upper jaw are a few series of smaller teeth; teeth in the lower jaw mostly in one series, outside of which are a few smaller teeth. Dorsal spines moderate; anal fin small, placed unusually far back, coterminous with the second dorsal. Second anal spine strong, nearly as long as the soft rays. Scales in less oblique series than usual. Gill-rakers long and slender. Soft dorsal and anal fins considerably scaly; pectoral fin quite short, not reaching half way to anal; caudal fin double truncate. Lower pharyngeals small, with sharp teeth. Eye

* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 83: type *Bodianus argyroleucus* Mitch. (Dedicated to Spencer F. Baird.)

rather large, equal to snout, 4 in head. Preorbital narrow. Head $3\frac{1}{3}$; depth about 3. D. XI–I, 22; A. II, 9; Lat. l. 50. Cape Cod to Florida; abundant southward.

(*Perca punctata* Linn. Syst. Nat. (two species of the same name): *Bodianus argyroleucus* Mitch. Trans. Lit. and Phil. Soc. N. Y. 417, pl. 6, fig. 3: *Corvina argyroleuca* Günther, ii, 299: *Homoprion xanthurus* Holbrook, Ich. S. Car. 1860, 164.)

aa. Teeth in both jaws in broad bands.

c. Preopercle with its bony margin serrate.

d. Outer teeth in upper jaw considerably enlarged. (*Sciænops** Gill.)

897. S. jacobi (Steind.) J. & G.

Body moderately elevated; mouth moderate, rather inferior; maxillary reaching middle of eye; outer row of teeth in each jaw slender, somewhat enlarged, those in upper jaw much larger than in lower; preopercle finely serrate. Dorsal spines very slender, the fourth half length of head, higher than the soft rays; second anal spine more than twice as strong as dorsal spines, as long as from middle of eye to edge of opercle, lower than the soft rays. Caudal truncate or slightly concave; pectoral shorter than ventrals, the first ray of the latter being filamentous. Scales on body and head ctenoid. Silvery gray, darker above; three dark brown longitudinal stripes along sides, the lower broadest, extending from eye to middle of caudal, the middle one running to upper edge of tail, the upper to soft dorsal; below these stripes are sometimes feebler ones, besides brownish lines following the rows of scales; fins plain, more or less punctulate; markings probably less distinct in the adult. Head 3; depth 3. D. X–I, 27; A. II, 8; scales 11–56–16. San Diego, California. (*Steindachner.*)

(*Corvina* (*Johnius*) *jacobi* Steind. Ichth. Beiträge, viii, 3, 1879.

898. S. ocellata (L.) Gthr.—*Channel Bass; Red Horse; Red Bass.*

Grayish silvery, iridescent; scales with dark spots forming faint irregular undulating stripes; upper part of base of caudal with an oval black spot as large as the eye, bordered by white or orange, this spot often duplicated. Body rather elongate, not much elevated, compressed behind, an almost even curve from snout to base of dorsal; preopercle distinctly serrate; eye large, $1\frac{1}{2}$ in snout, $5\frac{1}{2}$ in head; gill-rakers short and thick; mouth large, maxillary nearly reaching the posterior margin of the orbit. Caudal truncate; second anal spine rather strong, two-thirds as long as first ray; pectoral fins very short, not reaching half way to anal. Lower pharyngeals narrow, with conical teeth. Head $3\frac{1}{3}$;

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* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 30: type *Perca ocellata* L. (σκίαινα, sciæna; ὤψ, appearance.)

depth 3½. D. X–I, 25; A. II, 8; Lat. l. 50. Cape Cod to Mexico; common southward; known at sight by the peculiar caudal spot.

(*Perca ocellata* L. Syst. Nat.: *Corvina ocellata* Cuv. & Val. v, 134: *Corvina ocellata* Holbrook, Ich. S. C. 1860, 150; Günther, ii, 289.)

dd. Outer teeth in upper jaw scarcely larger than others; lower pharyngeals enlarged, their teeth paved. (*Roncador** J. & G.)

899. S. stearnsi (Steindachner) Jor. & Gilb.—*Roncador.*

Grayish silvery, with bluish lustre, some streaks of dark points along the rows of scales; breast and belly with two dusky lengthwise streaks; a very conspicuous, large, jet black spot at base of pectoral, including the axil and the base of the fin; fins grayish, with dusky shades; inside of mouth, branchiostegals, and peritoneum mostly black. Body oblong, heavy forward, the shoulders elevated and the profile steep; mouth rather large, maxillary reaching beyond middle of eye. Teeth in both jaws in a broad villiform band, the outer row scarcely enlarged; no canines; preopercle strongly dentate; gill-rakers slender, rather short; lower pharyngeals broad, the teeth mostly paved; eye large. Spinous dorsal not much elevated; second anal spine shortish, about half the height of the soft rays, very stout; pectoral elongate, reaching much past the tips of the long ventrals; caudal fin lunate, the upper lobe the longer. Head 3⅔; depth 3. D. X–I, 24; A. II, 8; Lat. l. 60. L. 30 inches. Coast of California, north to Point Concepcion; a large and valued food-fish, singularly distinguished by its black pectoral spot.

(*Corvina stearnsi* Steindachner, Ichthyol. Beiträge, iii, 1875, 22: *Roncador stearnsi* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 28.)

cc. Preopercle with an entire, membranaceous border.

d. Dorsal with less than 30 soft rays. (*Sciænat.*)

900. S. saturna (Grd.) J. & G.—*Red Roncador.*

Blackish, with coppery lustre; each scale with a cluster of dark points; a dark opercular patch; fins rather dark; belly silvery, but dusted with dark specks. Body oblong, with the antedorsal region convex and the profile nearly straight. Maxillaries not reaching to posterior border of eye. Teeth in lower jaw in a broad villiform band; upper jaw with a similar band, in front of which is a single row of large teeth; lower pharyngeals narrow, with conical teeth. Gill-rakers short

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* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 28: type *Corvina stearnsi* Steindachner. (Spanish *roncador*, grunter.) This is perhaps a valid genus, distinguished from *Sciæna* by its large, paved pharyngeals, resembling those of *Pogonias*, but not united.

† = *Corvina* Cuvier, Règne Anim. ed. 2, ii, 173, 1829: type *Sciæna nigra* Bloch = *Sciæna umbra* L. None of the species of the group called *Sciæna* by Cuvier were known to Linnæus.

and thick. Scales on head ctenoid. Second anal spine very stout, nearly as high as the soft rays; caudal fin slightly lunate. Head $3\frac{1}{2}$; depth $2\frac{2}{3}$. D. X–I, 23; A. II, 7; Lat. l. 55. Pacific coast, north to Point Concepcion.

(*Amblodon saturnus* Grd. U. S. Pac. R. R. Surv. Fish. 93: *Rhinoscion saturnus* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 85: *Corvina saturna* Günther, ii, 298.)

dd. Dorsal with more than 30 soft rays. (*Pareques** Gill.)

901. S. acuminata (Bloch & Schneider) J. & G.

Everywhere blackish, with traces of about 10 narrow horizontal streaks along the sides; spinous dorsal quite black. [Young specimens yellowish, with 7 or 8 straight longitudinal dark bands about as wide as the interspaces; dorsal fin similarly banded.] Form of *S. saturna*, the back somewhat elevated, the profile steep and nearly straight from the tip of the conical and rather pointed snout to the base of the dorsal. Mouth not large, the maxillary extending to below the middle of the eye. Lower jaw included; both jaws with broad bands of villiform teeth, the anterior series in the upper jaw considerably enlarged. Scales on the head scarcely ctenoid above, cycloid on the cheeks. Gill-rakers short, rather stout. Pectorals very short, not reaching half way to the tips of the ventrals, and but half way to the anal; as long as from the snout to the edge of the preopercle; anal fin small, its tip not reaching to the last ray of the second dorsal, its spine robust, nearly as high as the fin, half the length of the head; first dorsal small, with slender spines; second dorsal very long, its tip nearly reaching caudal. Eye rather large. Head $3\frac{1}{5}$; depth 3. D. IX, I, 36; A. II, 7; Lat. l. 53. West Indies to Florida. Here described from a specimen lately taken by Mr. Silas Stearns at Pensacola, Fla.

(*Grammistes acuminatus* Bloch & Schn. 1801, 184: *Eques acuminatus* Günther, ii, 280: *Pareque acuminatus* Gill, l. c.)

297.—LIOSTOMUS Lacépède.

Spots.

(*Liostomus* Lacépède, Hist. Nat. Poiss. iv, 439, 1802: type *Liostomus xanthurus* Lac.)

Body oblong, ovate, the back compressed. Head obtuse. Mouth small, horizontal, the upper jaw with a band of feeble teeth, the lower nearly or quite toothless; lower pharyngeals separate, the teeth paved. Preopercle with a membranaceous border. Dorsal spines 10, slender, rather high, the last connected with the soft rays; anal spines 2, the

*Gill, in Goode, Bull. U. S. Nat. Mus. 1876, v, 50: type *Grammistes acuminatus* Bloch & Schneider. ($\pi\alpha\rho\alpha$, near: *Eques*.)

second not large; caudal fin emarginate. Gill-membranes slightly connected; gill-rakers slender. (λεῖος, smooth; στόμα, mouth—the mouth having been originally described as toothless.)

902. L. xanthurus Lac.—*Spot; Goody; Oldwife; La Fayette.*

Bluish above, grayish silvery below; sides with about 15 dark bands, extending from the dorsal obliquely forward to below the lateral line; a distinct round dark humeral spot; fins plain olivaceous; caudal not yellow. Profile steep; snout blunt and gibbous; interorbital region narrow. Fins small, the spines weak; second anal spine about half as long as the longest soft ray; upper lobe of caudal longest. Head $3\frac{1}{2}$; depth 3. D. X, I, 32; A. II, 12; Lat. l. 60. L. 12 inches. Cape Cod to Florida; a valuable food-fish southward.

(Lacépède, iv, 439; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 32: *Homoprion xanthurus* Holbrook, Ich. S. C. 1860, 164: *Sciæna xanthurus* Günther, ii, 288: *Mugil obliquus* Mitchill, Trans. Lit. and Phil. Soc. N. Y. i, 405: *Liostomus obliquus* Holbrook, Ich. S. C. 1860, 160: *Sciæna obliqua* Günther, ii, 288: *Leiostomus humeralis* and *xanthurus* C. & V. 141, 142. The alleged species "*obliquus*" and "*xanthurus*" differ in color, "*xanthurus*" being plain golden, without spots or bars; tail yellow; probably based on faded museum specimens.)

298.—GENYONEMUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 87: type *Liostomus lineatus* Ayres.)

Body elongate, moderately compressed, the back little elevated. Head oblong, the snout abruptly decurved. Eyes moderate, anterior. Preopercle with a crenulated membranaceous edge. Mouth rather large, subterminal, somewhat oblique. Lower jaw with several very small barbels and with a few large pores. Teeth equal, in villiform bands, the anterior series scarcely enlarged. First dorsal with about 13 spines; anal with 2 spines, the second short and feeble; caudal emarginate. Pharyngeal bones and teeth as in *Micropogon*. Air-bladder simple. Gill-rakers slender, rather long. Size small. (γενυς, lower jaw; νῆμα, barbel.)

903. G. lineatus (Ayres) Gill.—*Little Roncador.*

Silvery with brassy lustre and black punctulations, these forming faint oblique dark lines along the rows of scales; fins yellowish; axil black. Head conic, rather blunt; maxillary reaching silghtly beyond middle of pupil. Barbels 5–8, minute, on the inner edge of each dentary bone. Anal spines very small, the second not half the height of the soft rays; pectorals and ventrals moderate, not reaching vent; caudal concave. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. XIII, I, 22; A. II, 11; Lat. l. 55.

L. 10 inches. Pyloric cœca 8; air-bladder simple. Coast of California; very common.

(*Liostomus lineatus* Ayres, Proc. Cal. Acad. Nat. Sci. i, 25, 1855; Girard, U. S. Pac. R. R. Surv. Fish. 99: *Sciæna lineata* Günther, ii, 288.)

299.—MICROPOGON Cuvier & Valenciennes.

Croakers.

(Cuv. & Val. Hist. Nat. Poiss. v, 213, 1830: type *Micropogon lineatus* C. & V. = *Perca undulata* L.)

Body moderately elongate, compressed, somewhat elevated. Preopercle strongly dentate. Teeth in villiform bands, the outer row in the upper jaw enlarged; lower jaw with a row of minute barbels on each side. Second anal spine moderate. Caudal fin double truncate. Lower pharyngeals narrow, distinct, with conical teeth. Gill-rakers moderate, rather slender. Air-bladder with long horns. (μικρὸς, small; πώγων, beard.)

904. M. undulatus (L.) C. & V.—*Croaker.*

Color grayish-silvery, with bright reflections; sides and back with narrow, irregular, undulating lines of dots; dorsal fins with three lines of dots along base. Body rather elongate, slightly elevated, the back somewhat compressed. Head long, the snout prominent, not strongly convex. Mouth rather large, nearly horizontal, the maxillary reaching to front of eye. Eye 2 in snout. Preopercle strongly serrate; the spines near angle diverging. Dorsals nearly separate, the first high; pectorals moderate, nearly reaching tips of ventrals; ventral filamentous; anal inserted nearly under middle of second dorsal; the second spine rather weak, shorter than snout, one-third length of head. D. X, I, 27; A. II, 8; Lat. l. 60; cœca 8. Head $3\frac{1}{8}$; depth $3\frac{1}{2}$; eye 5 in head, rather less than interorbital width. L. 12 inches. New York to West Indies; common southward.

(*Perca undulata* L. Syst. Nat.; Cuv. & Val. v, 219; Holbrook, Ich. S. Car. 1860, 146; Günther, ii, 271: *Micropogon lineatus* Cuv. & Val. v, 215.)

300.—UMBRINA Cuvier.

(Cuvier, Règne Anim. ed. 1, 297, 1817: type *Sciæna cirrhosa* L.)

Body moderately elongate; back somewhat arched. Head oblong, with the snout thick and protuberant. Mouth almost horizontal, of moderate size. Preoperculum with its bony margin finely serrate. Lower jaw with a single thickish barbel. Teeth in villiform bands, the outermost in the upper jaw somewhat enlarged. Anterior dorsal

with about 10 spines; anal fin with 2 spines, the second not very small. Caudal lunate or truncate. Gill-rakers normal, but short. Air-bladder present. In most warm seas. (Latin, *umbra*, shade; the name *umbra* was used for the typical species by early writers.)

a. Sides without vertical bars.

905. U. roncador Jor. & Gilb.—*Yellow-finned Roncador.*

Bright silvery, bluish above, with brassy reflections; sides with narrow, distinct, undulating streaks of deep olive, running from the head and pectoral region upward and backward, with some abrupt curvatures, to the base of the dorsal fin, sometimes alternating with lines of spots; no vertical bars; cheeks pure white; fins mostly yellow; peritoneum black. Body elliptical-elongate, the back somewhat elevated, the curve from snout to dorsal regular. Head conical, bluntish. Mouth horizontal, the maxillary extending to beyond front of pupil; eye moderate, $1\frac{1}{2}$ in snout, $5\frac{1}{2}$ in head, $1\frac{1}{3}$ in interorbital width. Caudal lunate, the upper lobe the longer. Second anal spine strong, $2\frac{1}{2}$ in head, a little shorter than third dorsal spine. Pectoral short and small, not reaching tips of ventrals, and not half way to vent; its length $1\frac{1}{2}$ in head. Head $3\frac{4}{5}$; depth $3\frac{1}{3}$. D. X–I, 27; A. II, 7; Lat. l. 58. L. 15 inches. Point Concepcion to Panama abundant; one of the handsomest of the Sciænoids.

(Jor. & Gilb. Proc. U. S. Nat. Mus. 1881: *Umbrina undulata* Steindachner, Ichthyol. Beiträge, iii, 21, 1875; not of Girard.)

aa. Sides with vertical bars.

906. U. broussonetı Cuv. & Val.

Body with about 9 dark cross-bands, besides undulating streaks along the rows of scales; spinous dorsal blackish. Body rather stout, the back somewhat elevated; maxillary extending to pupil; preopercle finely denticulate on its bony edge; barbel short; pectoral fins short and small, not reaching to tips of ventrals nor half way to vent; caudal truncate; second anal spine thick, $\frac{2}{5}$ the length of the head. Eye $3\frac{2}{3}$ in head. Head $3\frac{3}{4}$; depth 3. D. X–I, 28; A. II, 7; scales 5–48–10. West Indies, north to East Florida.

(Cuv. & Val. v, 187; Günther ii, 277; Jordan, Proc. U. S. Nat. Mus. 1880, 17: *Umbrina coroides* Cuv. & Val. v, 187.)

303.—MENTICIRRUS Gill.

King-fish.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 86: type *Perca alburnus* L.)

Body comparatively elongate, little compressed; head long, subconic, the bluntish snout considerably projecting beyond the mouth; mouth

small, horizontal, both jaws with bands of villiform teeth, the outer teeth in the upper jaw more or less enlarged; chin with a single stoutish barbel; preopercle with its membranaceous edge serrulate; gill-rakers short, tubercular; dorsal spines high, slender; second dorsal long and low; caudal fin with the lower angle rounded, the upper sharp; anal fin with a single weak spine; no air-bladder. Lower pharyngeals separate, small, with sharp teeth. Species numerous in American waters. (Latin, *mentum*, chin; *cirrus*, barbel.)

a. Outer row of teeth in upper jaw not greatly enlarged.

907. M. nebulosus (Mitchill) Gill.—*Whiting; King-fish; Barb.*

Bright grayish silvery, with irregular dark bars, those in front running obliquely backward and downward, those behind obliquely forward and downward; fins all dusky. Body elongate, terete, but little compressed; snout very blunt; profile evenly curved; eyes very small, about 2 in snout; outer teeth not much enlarged; pectoral fins short and broad, scarcely reaching tips of ventrals, $1\frac{1}{3}$ in head; ventrals $1\frac{3}{4}$ in head; dorsal fins scarcely connected; spinous dorsal high, its height three-fourths length of head; anal spine very weak, less than half the height of fin. Head $3\frac{3}{4}$ in length; depth $4\frac{3}{4}$. D. X–I, 26; A. I, 8; Lat. l. about 68. Cape Cod to Cape Hatteras; common northward; an important food-fish.

(*Sciæna nebulosa* Mitch. Trans. Lit. and Philos. Soc. N. Y. i, 403, 1815: *Umbrina nebulosa* Günther, ii, 275.)

908. M. littoralis (Holbrook) Gill.—*Surf Whiting.*

This species is said to be distinguished from *M. alburnus* by the plain silvery color and the absence or reduction of the outer series of larger teeth. Form entirely similar to that of *M. alburnus*. D. X–I, 27; A. I, 9. Coast of South Carolina. (*Holbrook.*)

(*Umbrina littoralis* Holbrook, Ich. S. Car. 1860, 144: *Umbrina littoralis* Günther, ii, 276.)

aa. Outer row of teeth in upper jaw much enlarged.

909. M. alburnus (Linn.) Gill.—*Whiting.*

Silvery, faintly clouded along the back and sides, these marks forming dusky bars, running obliquely forward and downward to below the lateral line, sometimes obsolete. Body elongate, rather slenderer than in *nebulosus*; back slightly arched; belly nearly straight. Snout broad, depressed, and bluntish, protruding beyond the mouth. Outer teeth of upper jaw very strong. Maxillary reaching to below middle of the small eye. Third dorsal spine highest, less than half the length of the soft dorsal, and two-thirds the length of head; pectorals broad,

rather long, their tips reaching beyond ventrals, their length $1\frac{1}{5}$ in head; ventrals 2 in head. Head $3\frac{1}{3}$ in length; depth about 4. D. X–I, 25; A. I, 7; Lat. l. 65. South Atlantic coast of United States.

(*Perca alburnus* Linn. Syst. Nat.: *Umbrina alburnus* Günther, ii, 275: *Umbrina alburnus* Holb. Ich. S. C. 1860, 137: *Umbrina phalæna* Girard, Mex. Bound. Surv. Ichth. 1859, 13.)

910. M. undulatus (Grd.) Gill.—*Bagara; "Sucker".*

Sooty grayish, with bright reflections, the back, all the fins, and under side of the head dusky with dark points; undulating lines along sides running upward and backward; back often with very faint dark cross-bars. Body elongate, the back not elevated. Head bluntish. Eye small, $2\frac{1}{2}$ in snout, 7 in head, the maxillary scarcely extending to its front. Anterior teeth of upper jaw strong. First dorsal high, its longest spine reaching past front of second dorsal; anal small, nearly under the middle of second dorsal, $1\frac{1}{2}$ in head; pectoral fins reaching past tips of ventrals nearly to vent, their length $1\frac{1}{9}$ in head. Head 4; depth 4. D. X–I, 26; A. I, 8; Lat. l. 60. L. 18 inches. Pacific coast, from Panama north to Point Concepcion; abundant.

(*Umbrina undulata* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 148, and in U. S. Pac. R. R. Surv. Fish. 101 (the type, a very young specimen, examined by us): *Umbrina elongata* Günther, Proc. Zoöl. Soc. London, 1864, 148.)

302.—LARIMUS Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poiss. v, 145, 1830: type *Larimus breviceps* C. & V.)

Body oblong, compressed; snout very short and blunt; mouth very oblique, large, the lower jaw projecting; teeth small, in villiform bands; no barbels; preopercle finely serrated; pseudobranchiæ present; air-bladder simple; vertebræ as usual; lower pharyngeals distinct, with pointed teeth; dorsal fins connected, the first moderate, the second long; anal fin very small, placed well back, provided with 2 spines; caudal fin convex. (An ancient name of some fish, from λαρός, pleasant, dainty.)

911. L. fasciatus Holbrook.

Silvery gray, clouded above; sides marked with about 7 nearly vertical dusky bars, running from the back to below the lateral line. Body oblong, compressed, ventral outline nearly straight, dorsal outline considerably arched; snout very short, much less than the diameter of the large eye; mouth large, very oblique, maxillary nearly reaching posterior margin of orbit; tip of mandible on level of lower part of pupil;

second anal spine small; pectoral fin short and caudal subtruncate. Head $3\frac{1}{2}$; depth about 3. D. X–I, 24; A. II, 6; Lat. l. about 62. (*Holbrook.*) South Atlantic coast and southward; rare.

(Holbrook, Ich. S. C. 1860, 154; Günther, ii, 269.)

303.—ATRACTOSCION Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 18: type *Otolithus æquidens* Cuv. & Val.)

This genus differs from *Cynoscion* only in the dentition, the bands of teeth being somewhat broader and some of the teeth near the middle of the upper jaw enlarged, but not forming canines. The species are among the largest of the *Sciænidæ*, and as food-fishes they are among the best. (ατραχτος, a spindle; σχιον, Sciæna.)

912. A. nobile (Ayres) Gill.—*White Sea Bass; Sea Trout; Corvina.*

Dull silvery, bluish above; everywhere punctulate; young with obscure, dusky cross-bars; axil and fins dusky. Body elongate-elliptical, not much compressed; head slender, conical, the snout rather pointed; mouth terminal, oblique, the lower jaw the longer; maxillary reaching to beyond pupil; premaxillary in front on the level of the orbit; teeth in lower jaw enlarged and in a single row laterally, anteriorly smaller, in a broad patch, the inner series in both jaws reflexed and movable; upper jaw with about two series on sides forming a broad cardiform patch in front; a few of the teeth near the middle of the jaw enlarged but not canine-like; gill-rakers moderate, very strong; scales very thin, weakly ctenoid; anal spines 2, weak, the first sometimes obsolete; fins low, pectoral not reaching half way to vent; caudal lunate, the upper lobe generally longest. Head $3\frac{1}{2}$; depth 4. D. X–I, 21; A. II, 9; Lat. l. 88 (tubes); more than 100 series of scales. Pacific coast north to San Francisco; one of the largest and most valuable of our Sciænoid fishes, reaching a weight of 60 to 70 pounds. The flesh is firm and rich.

(*Johnius nobilis* Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 78; Gill, Proc. Acad. Nat. Sci. Phila. 1862, 18: *Otolithus californensis* Steindachner, Ichth. Beiträge, iii, 31, 1875, the young or "Sea Trout.")

304.—CYNOSCION Gill.

Weak-fishes.

(*Cestreus* Gronow; not of C. & V.)

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 49: type *Johnius regalis*, Bloch.)

Body elongate, little compressed; the back not elevated. Head conical, rather pointed. Mouth larger than in our other Sciænoids; the lower jaw projecting. Maxillary very broad. Teeth sharp, not closely

set, in rather narrow bands; the lower jaw without canines; upper jaw with two long canines, one of which is sometimes obsolete; lateral teeth of lower jaw larger than anterior. Preopercle with its membranaceous edge serrulate, the bone entire. Lower pharyngeal bones separate, their teeth all pointed. Gill-rakers strong, rather long. Vertebræ about 14 + 10 (instead of 10 + 14 as in *Sciænoids* generally). Pseudobranchiæ well developed. Dorsal spines slender; anal spines 1 or 2, very feeble; second dorsal long and low; caudal fin subtruncate or lunate. Large fishes chiefly of the waters of America, closely related to the Old World genus *Otolithus*, from which they are distinguished by the absence of canines in the lower jaw. All of them rank high as food-fishes; the flesh is rich, but tender and easily torn; hence the popular name of Weak-fishes. (χύων, dog; σχιον, Sciæna; the modern Greek name of *Umbrina cirrhosa*.)

a. Anal spines 2.

913. C. parvipinne Ayres.—*Blue-fish; Corvina.*

Clear steel-blue above, without stripes or spots, silvery below; a narrow dusky shade along the sides below the lateral line; axil dusky; lower fins yellowish with dusky shading; upper fins dark; the second dorsal dark-edged. Body elongate, compressed, little elevated. Head conic, rather pointed. Mouth large, the maxillary extending to beyond the pupil. Eye large, a little shorter than snout, 6 in head. Teeth moderate, in a rather broad band; canines very long and strong, usually but one present. Fins rather low; caudal lunate; pectoral short, not reaching to the tips of the ventrals. Gill-rakers strong, rather long. Head $3\frac{1}{2}$; depth $4\frac{1}{4}$. D. IX–I, 23; A. II, 10; the first anal spine extremely small. Lat. l. with 75 tubes; the number of scales about 95. L. 30 inches. Pyloric cœca 3. Air-bladder long, with two appendages. Coast of California and Mexico, chiefly south of Santa Barbara. An excellent food-fish.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1861, 156: *Otolithus magdalenæ*, Steindachner, Ichth. Beiträge, iii, 1875.)

aa. Anal spine single.

c. Back uniform silvery white, without dark spots or blotches.

914. C. nothum Holb.—*White Trout; Sea Trout.*

Uniform bright silvery, bluish above. Body elongate, little compressed. Back more arched than in the other species. Mouth moderate, oblique; lower jaw longest; maxillary reaching opposite middle of eye. Eye large, about as long as snout. Head $3\frac{1}{4}$; depth $3\frac{3}{4}$. D. X–I, 28 (X–

I, 25, *Günther*); A. I, 10; Lat. l. about 68. (*Holbrook.*) Coast of South Carolina and southward.

(*Otolithus nothus* Holbrook, Ich. S. C. 1860, 134: *Otolithus nothus* Günther, ii, 308.)

cc. Back irregularly speckled and blotched, the spots forming undulating streaks.

915. C. regale (Bloch & Schneider) Gill.—*Weak-fish; Squeteague; Gray Trout.*

Silvery, darker above and marked with many small, irregular dark blotches, some of which form undulating lines running downward and forward; back and head with bright reflections; dorsal and caudal fins dusky; ventrals, anal, and lower edge of caudal yellowish, sometimes speckled. Maxillary reaching to beyond pupil; teeth sharp, in narrow bands. Pectorals short, scarcely reaching tips of ventrals, a little more than half length of head; longest dorsal spine as long as maxillary, not half length of head. Head $3\frac{1}{2}$ in length; depth $4\frac{1}{4}$. Eye about $1\frac{1}{3}$ in snout. D. X–I, 29; A. I, 13; Lat. l. 78. Cape Cod to South America; very abundant, and highly valued as a food-fish.

(*Johnius regalis* Bl. & Schn. 1801, 75: *Otolithus regalis* Holbrook, Ich. S. C. 1860, 129: *Otolithus regalis* Günther, ii, 307.)

916. C. thalassinum (Holb.) Gill.

Silvery, darker above, and marked with many interrupted narrow dark lines, directed from back obliquely forwards; belly yellow, the color running up on the sides. Body longer and less elevated than in the preceding, and with a sharper snout. Head $3\frac{1}{2}$ in length; depth about $4\frac{1}{2}$. D. X–I, 26; A. I, 9. South Atlantic coast of United States. A doubtful species, distinguished from *C. regale* by the fewer fin rays.

(*Otolithus thalassinus* Holbrook, Ich. S. C. 1860, 133; not *Otolithus thalassinus* Günther, ii, 308.)

bbb. Back and upper fins with many conspicuous round black spots.

917. C. maculatum (Mitchill) Gill.—*Spotted Sea Trout.*

Bright silvery, darker above; back posteriorly with numerous round black spots as large as the pupil; both dorsal and caudal fins marked with similar, somewhat smaller spots, much as in a trout; anal dusky. Maxillary reaching to posterior edge of eye; canines moderate. Longest dorsal spine not quite half the length of the head; pectorals short, not reaching tips of ventrals, not half length of head; caudal lunate. Head $3\frac{1}{2}$; depth 5. Eye large, about 6 in head. D. X–I, 25; A. I, 10; Lat. l. about 90. Virginia to Mexico; very abundant southward.

(*Labrus squeteague* var. *maculatus* Mitchill, Trans. Lit. & Phil. Soc. i, 396, 1815: *Otolithus carolinensis* Cuv. & Val. ix, 475: *Otolithus carolinensis* Holbrook, Ich. S. C. 1860, 72: *Otolithus carolinensis* Günther, ii, 305: *Otolithus drummondi* Girard, U. S. Mex. Bound Surv. Ichth. 1859, 13; not of Richardson?.)

305.—SERIPHUS Ayres.

Queen-fishes.

(Ayres, Proc. Cal. Acad. Nat. Sci. pt. ii, 80, 1861: type *Seriphus politus* Ayres.)

Body oblong, compressed, covered with rather large, deciduous, ctenoid scales. Head deep, compressed, carinated behind, depressed above the eye. Snout bluntish, lower jaw projecting. Mouth large, oblique. Teeth small, sharp, separated, in narrow bands. Gill-rakers long. Pseudobranchiæ present. Preopercle with its membranaceous edge denticulated. Fins fragile, the soft parts scaly; dorsal fins well apart, the second unusually small, scarcely larger than the anal, which is unusually large; anal spines 2, feeble; caudal fin lunate. Vertebræ 14 + 10, as in *Otolithinæ*. Size small. (σέριφος, a small winged insect; also a kind of wormwood; the allusion not evident.)

918. S. politus Ayres.—*Queen-fish; King-fish.*

Bluish above, sides and below bright silvery, finely punctate; vertical fins all pale yellow; base of pectorals blackish. Body oblong, compressed. Depth of head $\frac{3}{4}$ its length. Mouth very large, oblique, the tip of the mandible on the level of the pupil, the broad maxillary reaching to the posterior margin of the pupil. Teeth small, sharp, separated, in about two series in front and one behind. Gill-rakers $\frac{2}{3}$ diameter of eye. Scales ctenoid, very deciduous. Spines very slender. Soft parts of vertical fins largely covered with small deciduous scales. Dorsals well separated, the second inserted in advance of the anal, which extends much further back; caudal concave; pectorals small, barely reaching tips of the small ventrals. Flesh very tender. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. D. VIII–I, 20; A. II, 21; Lat. l. about 60. L. 12–14 inches. Coast of California; very abundant southward; north to San Francisco.

(Ayres, Proc. Cal. Acad. Nat. Sci. ii, 80, 1861; Gill, Proc. Acad. Nat. Sci. Phila. 1862, 277.)

Family XCII.—GERRIDÆ.

(*The Gerroids.*)

Body oblong or elevated, compressed, covered with sparoid scales; lateral line continuous; mouth moderate, extremely protractile, descending when protruded, the spines of the premaxillary extending to above the eye, closing a deep groove in the top of the head; maxillary without supplemental bone, not slipping under the very narrow preorbital; its surface silvery, like the rest of the head; base of mandible scaly,

a slit between it and the preorbital to permit its free motion; both jaws with slender, villiform teeth; no incisors, canines, nor molars; no teeth on vomer or palatines; preopercle entire or serrate; sides of head scaly; nostrils double, round; pseudobranchiæ concealed; gill-rakers short, broad; gill-membranes separate, free from the isthmus; dorsal fin single, continuous or deeply notched, the spinous and soft portions about equally developed, with a scaly sheath along the base, as in *Embiotocidæ;* dorsal spines usually 9 or 10; anal usually with 3 spines; the soft portion of the fin similar to the soft dorsal, but shorter; ventral fins thoracic, I, 5; branchiostegals 6; lower pharyngeal bones firmly united, with a suture; air-bladder present; pyloric cœca rudimentary; vertebræ 10–14. Oviparous. Species about 30, inhabiting the tropical seas. They differ considerably in form, and in development of spines, but probably all may be referred to a single genus.

(*Gerridæ* Günther, iv, 252–264.)

306.—GERRES Cuvier.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type *Gerres plumieri* Cuv. & Val.)

Character of the genus included above. (An ancient Latin name of some similar fish.)

a. Preopercle serrate; second spines of dorsal and anal much enlarged. (*Gerres.*)

919. G. plumieri Cuv. & Val.

Brilliant silvery, a blackish stripe along each row of scales, making about 12 streaks, the upper concurrent with the back and thus strongly curved; fins, except the pectorals, dusky. Body compressed, the back much elevated, the profile steeply descending and somewhat concave, the snout rather pointed; lips full, mouth quite small, the maxillary reaching front of the pupil of the large eye, which is longer than snout, $3\frac{1}{2}$ in head; three rows of scales on cheek; scales large, smooth, adherent; longest dorsal spine nearly as long as head, longer than longest anal spine; pectorals narrow, pointed, reaching past tips of ventrals to anal; caudal forked; ventral with a large accessory scale. Lat. l. conspicuous, its scales 38. Head $3\frac{1}{3}$ in length; depth 2. D. IX, 12; A. III, 9, the last rays not much higher than the scaly sheath. West Indies, north to Eastern Florida.

(Cuv. & Val. vi, 452; Günther, iv, 253.)

aa. Preopercle entire; second spines of dorsal and anal little enlarged. (*Diapterus** Ranzani.)

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* *Diapterus* Ranzani, N. Comm. Ac. Sc. Bol. 1841: = *Eucinostomus* B. & G. (διαπτερος, having the fin divided.)

920. G. argenteus (Baird & Girard) Günther.

Silvery, without spots or streaks on body or fins; young sometimes barred. Mouth very small, maxillary reaching slightly beyond vertical from front of eye; scales large; spinous part of dorsal as long as soft; second dorsal spine scarcely half the length of head; soft dorsal extending a little further back than anal. Eye 3 in head Head $3\frac{1}{4}$; depth 3. D. IX, 10; A. III, 7 or 8. New Jersey to North Carolina.

(*Eucinostomus argenteus* Baird & Girard, Ninth Smithsonian Report, 1854, 335.)

921. G. homonymus (Goode & Bean) J. & G.

Silvery, brownish above, centre of scales with a darker spot; a black spot on spinous dorsal; young with transverse dark bars. Body oblong, compressed, highest at front of spinous dorsal; profile steep, not arched; mouth horizontal, maxillary reaching to below eye; eye large. Head $3\frac{2}{7}$ in length; depth $2\frac{1}{3}$; eye 3 in head. D. IX, 10; A. III, 8. L. lat. about 40. (*Baird & Girard.*) Atlantic coast of the United States; abundant southward.

(*Diapterus homonymus* Goode & Bean, Proc. U. S. Nat. Mus. ii, 340, 1879: *Eucinostomus argenteus* Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 17, not of B. & G.: *Gerres argenteus* Günther, iv, 256.)

922. G. harengulus (Goode & Bean) J. & G.

"The height of the body is contained 3 to $3\frac{1}{5}$ times in the total length without caudal, the length of the head $3\frac{1}{3}$ to $3\frac{1}{2}$ times; the diameter of the eye excels the length of the snout and is contained 3 times in the length of the head and equals the width of the interorbital space; the groove for the processes of the intermaxillaries is naked and extends to the vertical through the anterior third of the eye; the free portion of the tail is longer than high; the least height of tail equals the length of the 6th dorsal spine; the 3rd dorsal spine is the longest, its length being contained twice in the height of the body and equals the length of the head without the postorbital portion; the last dorsal spine equals in length the 2d anal, and about equals the length of the snout, and is about $\frac{2}{5}$ as long as the 3d; the first dorsal ray is fully $1\frac{1}{2}$ times as long as the 1st dorsal spine; the 2d anal spine is stronger and shorter than the 3rd, its length being contained $3\frac{2}{5}$ in the length of the head; the 3d anal spine is contained $3\frac{1}{3}$ times in the length of the head; the caudal is forked, its length slightly less than the length of the head, and very little greater than the length of the pectoral; the pectoral reaches to the perpendicular through the origin of the soft dorsal. The ventral is half as long as the head; the vent is under the 2d ray of the soft dor-

sal. D. IX, 10; A. III, 7; P. 15; V. I, 5; C. + 17 +. L. lat. 44; L. trans. $\frac{5}{10}$. The back has a slight tawny hue, interrupted as it blends with the white of the sides by five or six indistinct scollopy incursions of the body color, giving the upper part of the side of the fish a marbled appearance." (*Goode & Bean.*) West coast of Florida.

(*Eucinostomus harengulus* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 132, 340.)

Family XCIII.—EMBIOTOCIDÆ.

(*The Surf-fishes.*)

Viviparous Labroids. Body ovate or oblong, compressed, covered with cycloid scales of moderate size. Cheeks, operculum, and interoperculum scaly. Lateral line continuous, running high, without abrupt flexure; not extending on the caudal fin. Head rather short. Mouth small, terminal. Jaws with conical or compressed teeth of moderate or small size, in one or two series. No teeth on vomer or palatines; no canines; lower pharyngeals united, without suture, their teeth conical or paved. Upper jaw freely protractile. Lips full, the lower either forming a free border to the jaw or else attached by a frenum at the symphysis. Maxillary short, without supplemental bone, slipping for most or all of its length under the preorbital. Opercular bones entire. Branchiostegals 6 (or 5). Gill-rakers usually slender; gill-openings wide, the membranes free from the isthmus or very slightly connected; pseudobranchiæ present; gills 4, a slit behind the fourth. Nostrils round, 2 on each side. Dorsal fin single, long, with 8–18 usually slender spines, which are depressible in a groove. A sheath of scales along the base of the anterior part of soft dorsal and posterior part of spinous dorsal; this sheath separated by a furrow from the scales of the body. Anal fin elongate, with 3 moderate or small spines and 15–35 slender soft rays, its form and structure differing in the two sexes. Ventral fins thoracic, I, 5. Pectorals moderate. Caudal forked. Oviduct opening behind the vent, the two apertures always distinctly separated. Air-bladder large, simple. No pyloric cœca. Vertebræ 13–19 + 19–23.

Viviparous. The young are hatched within the body, where they remain closely packed in a sac-like enlargement of the oviduct analogous to the uterus, until born. These fœtal fishes bear at first little resemblance to the parent, being closely compressed and having the vertical fins exceedingly elevated. At birth they are from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in length, and similar to the adult in appearance, but more compressed, and red in color. Since the announcement of their viviparous

nature by Dr. Gibbons and Professor Agassiz, in 1853, these fishes have been the subject of much interest to anatomists.

Fishes of the Pacific coast of North America, inhabiting bays and the surf on sandy beaches. One species (*Hysterocarpus traski*) inhabits fresh waters, one (*"Ditrema" violaceum*) is found in Australia, and another (*Ditrema temmincki*) is found in Japan. The species reach a length of from 6 to 18 inches, and are very abundant where found. They are much used for food, but the flesh is poor and tasteless. Most of them feed on crustacea, but one genus (*Abeona*) is partly or wholly herbivorous. Genera 8; species 20.

(*Embiotocidæ* Günther, iv, 244–251.)

* Spinous dorsal longer than the soft part, of 16–18 spines; second anal spine the largest. (*Hysterocarpinæ.*)

a. Scales large; teeth moderate, conical, in one series; lower lip without frenum. HYSTEROCARPUS, 307.

** Spinous dorsal shorter than the soft part, of 8–11 spines; anal spines graduated. (*Embiotocinæ.*)

b. Scales large (40–50 in the lateral line); soft dorsal and anal more or less shortened.

c. Teeth incisor-like, most of them obtusely three-lobed; lower lip with a narrow frenum ..... ABEONA, 308.

cc. Teeth conic, entire ..... MICROMETRUS, 309.

bb. Scales small (60–75 in the lateral line).

d. Teeth in two series in each jaw ..... AMPHISTICHUS, 310.

dd. Teeth in a single series in each jaw.

e. Lower pharyngeal bone normal (with the posterior margin concave, the the lateral horns well developed, and the teeth all on the same plane, some conical, some truncate).

f. Lower lip with a frenum, its edge entire.

g. Abdomen much longer than the base of the short anal fin. HYPSURUS, 311.

gg. Abdomen much shorter than the base of the long anal fin. DITREMA, 312.

ff. Lower lip without frenum, its free fold incised behind; lips very large ..... RHACOCHILUS, 313.

ee. Lower pharyngeals peculiar, very large, posteriorly convex, the lateral horns little developed, the teeth on two separate planes which meet at an angle, the anterior teeth hexagonal and tessellated, the posterior appressed forwards ..... DAMALICHTHYS, 314.

307.—HYSTEROCARPUS Gibbons.

(Gibbons, Daily Placer Times and Transcript, May 18, 1854, and in Proc. Acad. Nat. Sci. Phila. 1854, 124: type *Hysterocarpus traski* Gibbons.)

Body ovate, the back strongly elevated and convex; head small, the snout projecting; mouth small, with one series of rather large, bluntly conical teeth; the jaws about equal; lips not much enlarged, the lower forming a free border, without frenum; gill-rakers moderate, widely set; branchiostegals 5; scales rather large, silvery; spinous dorsal very

long, of about 16 spines, highest at the fifth or sixth, thence gradually shortened each way, the last spines being shorter than the soft rays; anal spines stronger than in the other genera, curved, the second spine being longer and stronger than the first and third, which are nearly equal; soft rays of anal 20–23 in number, the anterior simply articulated. Fresh waters of California. (ὕστερος, later; καρπος, fruit; *i. e.*, fruit borne late; in allusion to the prolonged development of the embryo.)

923. H. traski Gibbons.

Males, above dark brown, sides yellowish or olivaceous, with fine black dots; throat and belly golden yellow; females olivaceous, darker above, with black blotches on sides in irregular transverse bars. Body oval, compressed; ventral curve less than that of the back; head small, profile from snout to occiput concave; mouth small, oblique, maxillary not reaching orbit; lateral line following the curve of the back; dorsal spines rather high, the fourth to seventh highest; cheeks with 3 rows of large scales. Head $3\frac{1}{3}$; depth 2. D. XVI, 11; A. III, 22; Lat. l. 40. Rivers of Central California, locally abundant.

(Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 105, 124; Günther, iv, 251.)

308.—ABEONA Girard.

Shiners.

(Girard, Proc. Acad. Nat. Sci. Phila. 1855, 322: type *Abeona trowbridgii* Grd. = *Cymatogaster minimus* Gibbons.)

Body ovate or oblong, compressed. Head moderate. Mouth small; the jaws about equal; lips rather thin, the lower with a narrow frenum; teeth in one principal series, besides which are often one or two other teeth, stout, somewhat compressed, and incisor-like; all or most of the teeth three-lobed. Gill-rakers very slender and short. Lower pharyngeals scarcely concave behind; the teeth all large and truncate. Scales large. Dorsal fin short and high; the spines robust; the middle ones highest and rather higher than the soft rays. Anal fin short and deep, with strong spines. Vertebræ (in *A. minima*) 14 + 19. Species of small size; partly or wholly herbivorous, feeding on sea-weeds. Coloration variegated. (A coined name without meaning.)

924. A. minima (Gibbons) Gill.

Color greenish above with bluish reflections, thickly dusted with black dots; an irregular longitudinal black band along axis of body, and two vertical dark bars downward from base of dorsal fin on which

they appear as blotches; sides often with much light yellow; axil of pectorals black. Body oval, compressed, with thick short caudal peduncle and very short head. Profile moderately depressed above the eyes. Spinous dorsal rapidly rising to the fifth or sixth spine, thence gradually descending; spinous dorsal higher than soft part; cheeks with scales in $2\frac{1}{2}$ series. Head $3\frac{1}{4}$; depth 2. D. IX, 14; A. III, 16; Lat. l. 45. L. 6 inches. Pacific coast of United States; common; the smallest of the family.

(*Cymatogaster minimus* Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 125: *Abeona trowbridgii* Girard, U. S. Pac. R. R. Surv. Fish. x, 186, pl. 34, fig. 6–10: *Ditrema minimum* Günther, iv, 249.)

925. A. aurora Jordan & Gilbert.

Color bluish-black above, becoming lighter on sides and silvery below. Opercles and lower half of sides punctate with black dots and shaded with light orange, the latter more intense on the centres of the scales and forming a diffuse lateral band; a broad grayish streak backwards from pectorals to opposite origin of anal, this streak without orange tint and with the margins of the scales dark by aggregation of black points; young specimens with the bright lateral shade more distinct, and rosy instead of orange; fins marked with more or less blackish, the anal with some yellowish; a conspicuous black triangular blotch in the axil of the pectoral. Body elongate, with a very long and rather thick caudal peduncle. Head transversely very convex above, and with a blunt snout. Mouth small, oblique; maxillary reaching but two-thirds the distance to front of orbit. Spinous dorsal with the fifth to the ninth spines highest, and about equal to the longest soft ray. Caudal forked for nearly half its length. Scales on cheeks in 3 distinct series. Head 4; depth $2\frac{3}{4}$. D. IX, 17; A. III, 20; Lat. l. 45. L. 7 inches. Monterey Bay, California; abundant in rock-pools.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 299.)

312.—MICROMETRUS Gibbons.

Sparadas.

(*Cymatogaster* and *Brachyistius* Gill: *Metrogaster* Agassiz.)

(Gibbons, Proc. Cal. Acad. Nat. Sci. in Daily Placer Times and Transcript, May 30, 1854: type *Cymatogaster aggregatus* Gibbons.)

Body elliptical, oblong, compressed. Head conic. Mouth small, oblique, the lower jaw slightly shorter; lips thin, the lower with narrow frenum or none; teeth small, conical, rather numerous, in one series. Gill-rakers moderate, slender. Scales comparatively large. Dorsal

spines rather high, some of the middle ones highest, the posterior not so high as the soft rays; the soft dorsal shortened. Anal moderate, with weak spines. Caudal forked. Pharyngeals normal, the teeth all conic. Vertebræ (in *M. aggregatus*) 15 + 20; in *M. frenatus* 13 + 21. Species of small size and bright coloration. (*μικρος*, small; *μετρος*, measure, *i. e.*, small size.)

a. Lower lip with a frenum. (*Brachyistius** Gill.)

926. M. frenatus (Gill) J. & G.

Body elongate, compressed, regularly elliptical, with a slender pointed head and a long caudal peduncle; profile much depressed over the eyes, the snout projecting. Mouth very small, oblique, maxillary not reaching orbit. Cheeks with two rows of scales. Dorsal spines very long and rather strong, the sixth and seventh the longest and a little longer than the soft rays. Caudal rather deeply forked. Gill-rakers slender, rather long. Color dark olive brown above, each scale with a dark spot at base, followed by a light mark; below bright light coppery-red; each scale with a blue spot and dark punctulations; head colored like the body; fins all light reddish. Head $3\frac{3}{4}$; depth 3. D. VIII, 15; A. III, 22; Lat. l. 40. L. 8 inches. Entire Pacific coast of United States; locally very abundant.

(*Brachyistius frenatus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 275: *Brachyistius frenatus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 304: *Ditrema brevipinne* Günther, iv, 248.)

927. M. rosaceus Jordan & Gilbert.

Body oblong-ovate, deepest at the shoulders; the profile thence to the occiput convex, the occipital and interorbital region considerably depressed; body tapering backwards from the shoulders into a short and slender caudal peduncle. Head small, thick, the snout blunt. Mouth comparatively large, little oblique, the lower jaw included; maxillary slightly passing the vertical from the front of the orbit; premaxillary anteriorly on a level with the inferior margin of the pupil. Eye very large, its diameter about one-third the length of the head; interorbital region very broad. Teeth large, conical, truncate at tip, about $\frac{12}{8}$; none on the sides of the lower jaw. Scales on the cheeks in three series. Spinous dorsal high; the first spine about two-fifths the length of the highest; the sixth to tenth of nearly equal height, and higher than the soft rays. Anal fin with the base oblique, the spines rather strong, and more or less curved. Caudal

*Gill, Proc. Acad. Nat. Sci. Phila. 1862, 275: type *Brachyistius frenatus* Gill. (*βραχύς*, short; *ἱστιον*, sail.)

fin narrow, forked for more than half its length, the lobes rather pointed, Pectoral fins small, not reaching to the tips of the ventrals. Color rose-red with silvery lustre, darker above; top of head orange; a very distinct chocolate-colored spot above the lateral line at the origin of the soft dorsal fin; another smaller one just below the end of the soft dorsal. Fins immaculate, tinged with reddish. Head $3\frac{1}{3}$; depth $2\frac{1}{2}$. D. X, 18; A. III, 20; scales 6–50–16. L. 8 inches. San Francisco, Cal., in deep water outside the Golden Gate.

(*Cymatogaster rosaceus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 303.)

aa. Lower lip without frenum. (*Micrometrus.*)

928. M. aggregatus Gibbons.—*Sparada; "Minnow."*

Silvery, back dusky; middle of sides anteriorly with the scales each with a cluster of dark points, these forming a series of longitudinal stripes, which extend to opposite the base of the anal; these stripes are interrupted by 3 vertical light yellow bars, on which are no black specks in the adult. Adult males in spring almost entirely black. Body elongate oval, compressed, heaviest at the front of the dorsal; caudal peduncle short and slender; head short; teeth very small, conical 12–6; dorsal spines high and rather feeble, rising rapidly to the fifth, thence slowly descending, the last lower than the soft rays. Cheeks with 3 rows of scales. Head $3\frac{1}{3}$; depth $2\frac{2}{3}$. D. IX, 20; A. III, 23; scales 3–38–11. L. 6 inches. Pacific coast of the United States, everywhere exceedingly abundant.

(*Cymatogaster aggregatus* Gibbons, l. c. May 18, 1854; Gibbons l. c. May 30, 1854; Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 125: *Cymatogaster aggregatus* Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 106: *Holconotus rhodoterus* Girard, U. S. Pac. R. R. Surv. Fish. 193: *Ditrema aggregatum* Günther, iv, 248.)

310.—AMPHISTICHUS Agassiz.

Wall-eyed Perch.

(*Holconotus* Agassiz: *Ennichthys* Girard: *Cymatogaster** and *Hyperprosopon* Gibbons: *Hypocritichthys* Gill.)

(Agassiz, Am. Journ. Sci. Arts. 1854, 367: type *Amphistichus argenteus* Agassiz.)

Body ovate or oblong, strongly compressed. Mouth moderate, oblique or almost vertical, with slender conical teeth in two series in each jaw, the outer series longer; lips thin, the lower with or without frenum. Gill-rakers long or short, slender and stiff. Pharyngeals normal. Fins

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* The genus *Cymatogaster* Gibbons, as first defined by its author, is equivalent to the earlier *Holconotus* of Agassiz. Prior to this, the name *Cymatogaster* was used by Gibbons, without explanation, as the generic name of the group afterwards called by him *Micrometrus*.

not very high, the spines slender. Scales small, 60–75 in the course of the lateral line. Species 5, differing considerably in form and appearance, but agreeing in essential characters. (*αμφι*, double; *στιχος*, series.)

* Lower lip without frenum; gill-rakers numerous, long.
a. Profile depressed or concave over the eyes; mouth very oblique, the lower jaw projecting; eye very large.
b. Anal fin short, its rays about III, 23. (*Hypocritichthys** Gill.)

929. A. analis (A. Agassiz,) Jor. & Gilb.

Silvery; an inky blotch on the middle of the anal fin and a fainter blotch on the spinous dorsal; front of anal yellow; fins otherwise plain. Axil black. Body comparatively elongate, formed much as in *Micrometrus frenatus;* upper anterior profile nearly straight, depressed above the eyes. Snout sharp. Mouth large, very oblique, the tip of the lower jaw on a line with the upper profile of the snout; maxillary reaching front of orbit. Dorsal spines high and slender, longer than the soft rays, the middle longest. Anal spines small. Caudal fin short, not widely forked; pectorals short and broad, four-fifths the length of head. Eye, five fourths the length of snout. Head $3\frac{1}{2}$; depth $2\frac{1}{2}$. D. IX, 22; A. III, 23; Lat. l. 63. L. 6 inches. San Francisco to Point Concepcion; rather rare; locally abundant at Santa Cruz.

(*Hyperprosopon analis* Alex. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 133: *Hypocritichthys analis* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 276: *Ditrema anale* Günther, iv, 250.)

b. Anal fin long, its rays about III, 33. (*Hyperprosopon*† Gibbons.)
c. Ventral fins posteriorly black.

930. A. arcuatus (Gibbons) J. & G.—*Wall-eyed Perch; White Perch.*

Bluish black above; sides bright silvery, sometimes faintly barred; ventrals with a broad terminal bar of black; caudal and anal edged with blackish. Body ovate, strongly compressed. Interorbital space rather wide, abruptly depressed at the nape, the profile of the snout extending forward at a less angle than that of the back. Snout very short, much shorter than the eye. Maxillary scarcely reaching front of pupil. Mouth extremely oblique. Eye $2\frac{1}{2}$ in head, larger than in any other species. Middle dorsal spines a little higher than the last, or than the soft rays; anal low. Head $3\frac{1}{2}$; depth $2\frac{1}{8}$. D. IX, 27; A.

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*Gill, Proc. Acad. Nat. Sci. Phila. 1862, 276: type *Hyperprosopon analis* A. Ag. (*ὑποκριτος*, deceiver; *ἰχθὺσ*, fish; its appearance (*Micrometrus*) belying its affinities (*Holconotus*).

†Gibbons, Daily Placer Times and Transcript, May 18, and in Proc. Acad. Nat. Sci. Phila. 1854, 103: type *Hyperprosopon argenteus* Gibbons. (*ὑπηρ*, above; *πρόσωπον*, face.)

III, 32; Lat. l. 72. L. 10 inches. Coast of California, from Cape Mendocino southward; very abundant.

(*Hyperprosopon argenteum* Gibbons, Proc. Acad. Nat. Sci. Phila. 1854, 105: *Hyperprosopon arcuatum* Gibbons, l. c. 125: *Hyperprosopon argenteus* and *arcuatus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 276: *Ditrema arcuatum* and *Ditrema megalops* Günther, iv, 249: *Ennichthys megalops* Girard, U. S. Pacific R. R. Surv. Fish. 197.)

cc. Ventral fins not black.

931. A. agassizi (Gill) J. & G.

Greenish olive above; sides bright silvery; 5 or 6 short blackish vertical bars on the sides, these sometimes obsolete; a dusky patch above anal and on the front part of anal fin; caudal reddish, dusky at tip; ventrals colorless. Body elliptic ovate, the profile nearly straight from the snout to above the occiput, there forming a slight angle, thence straightish to the base of dorsal; ventral outline variable, sometimes strongly arched. Mouth small, very oblique, the premaxillary on the level of the middle of the pupil, the maxillary scarcely reaching front of pupil. Eye half longer than the snout. Three rows of scales on cheek. Sixth dorsal spine highest, higher than the soft rays; pectorals falcate. D. IX, 25; A. III, 29; Lat. l. 60. L. 8 inches. Coast of California; not generally abundant.

(*Hyperprosopon arcuatus* Alex. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 125 (not of Gibbons): *Hyperprosopon agassizii* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 276.)

aa. Profile little depressed above the eyes; mouth less oblique, the lower jaw not projecting; eye scarcely longer than snout. (*Holconotus.**)

932. A. rhodoterus (Agassiz) J. & G.

Greenish above; sides silvery, profusely covered with spots and blotches of light orange-brown or coppery red, these mostly in the form of interrupted vertical bars; caudal, anal, and ventral fins bright reddish, without black spots or markings. Body deeper, more elevated, and less compressed than in the preceding species. Profile nearly straight from snout to dorsal. Mouth oblique, forming an angle of about 45 degrees; premaxillary on the level of the lower edge of pupil; maxillary reaching just past front of pupil. Gill-rakers fewer and stouter than in the preceding species. Head $3\frac{3}{4}$; depth 2. D. IX or X, 26; A. III, 29; Lat. l. 65. L. 1 foot. Coast of California; not very abundant.

(*Holconotus rhodoterus* L. Agassiz, Amer. Journ. Sci. Arts, 1854, 368: *Holconotus rhodoterus* A. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 132: *Ennichthys heermanni* Girard, U. S. Pac. R. R. Surv. Fish. 199: *Ditrema rhodoterum* Günther, iv, 250.)

aa. Lower lip with a frenum; gill-rakers few, short. (*Amphistichus.*)

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*Agassiz, Amer. Jour. Sci. Arts, 1854, 367: type *Holconotus rhodoterus.* (ὀλκος, furrow; νῶτος, back.)

933. A. argenteus Agassiz.—*Surf-fish.*

Silvery; sides with narrow vertical bars of a brassy olive color, alternating with vertical series of spots of similar color; fins plain; vertical fins sometimes edged with dusky. Mouth comparatively large, little oblique, the premaxillary being below the level of the rather small eye. Body ovate, the back elevated; ventral outline straightish. Head blunt and deep. Lips rather thin, the lower with a frenum. Gill-rakers few, rather short, stiff; lower pharyngeals normal. Caudal peduncle short and stout. Head $3\frac{1}{2}$; depth $2\frac{1}{4}$. D. X, 24; A. III, 26; Lat. l. 65. Vertebræ 13 + 18. L. 1 foot. Coast of California; very abundant.

(L. Agassiz, Amer. Journ. Sci. Arts, 1854, 367; Girard, U. S. Pac. R. R. Surv. Fish. 201: *Ditrema argenteum* Günther, iv, 251: *Amphistichus similis* Girard, U. S. Pac. R. R. Surv. Fish. 203.)

311.—HYPSURUS A. Agassiz.

(Alex. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 133 (*nomen nudum*): type *Embiotoca caryi* L. Agassiz.)

Body oblong, compressed, moderately elevated, tapering abruptly to a very slender and short caudal peduncle. Head moderate, rather acute, lower jaw included. Lips moderate, the lower with a frenum. Teeth few, conical, blunt, in one series, those of the upper jaw sometimes partly in 2 series. Gill-rakers slender, rather short. Pharyngeals normal. Dorsal fin rather low, the spines all lower than the soft rays. Caudal broad and short, widely forked. Anal fin extremely short, although many rayed, beginning far back, the length of its base being less than half the distance between its first spine and the root of the ventrals, the abdomen being therefore extremely long. Scales rather small. Vertebræ 17 + 20. This genus is distinguished from *Ditrema* chiefly by the great length of the abdominal region. Species of small size and brilliant coloration. (*δψι*, high; *ουρα*, tail.)

934. H. caryi (Louis Agassiz) Alexander Agassiz.—*Bugara.*

Coloration extremely variegated, olivaceous, with stripes of orange between the rows of scales; about 13 dusky orange cross-bars, irregular in form; eyes reddish, surrounded by a sky-blue band; membranes of opercles chiefly orange; opercle bluish, spotted with orange; sides of head with sky-blue spots; lower jaw with orange and blue stripes; breast and belly with longitudinal stripes of bright orange, alternating with steel-blue; abdominal furrow orange, edged with blue; pectoral with an orange crescent at base bordered with light blue; soft dorsal

with a black blotch near the front; caudal of a peculiar rich orange-brown, with cross-bars formed of round grayish spots; anal chiefly orange tipped with blue, and with a large blackish blotch; other fins orange-brown, mottled. Body elliptical, compressed, the ventral outline comparatively straight. Snout sharp; premaxillaries on the level of the lower margin of pupil. Fourth to sixth dorsal spines highest; higher than the soft rays. Pectoral long. Anal very short; its rays slender and crowded; its origin opposite posterior third of dorsal. Head $3\frac{1}{2}$; depth $2\frac{1}{2}$. D. X, 23; A. III, 24; Lat. l. 71. L. 10 inches. Coast of California; very common from Santa Barbara to San Francisco; a beautiful fish, largely used for bait.

(*Embiotoca caryi* Agassiz, Amer. Journ. Sci. Arts, 1853, 389, and 1854, 366: *Ditrema caryi* Günther, iv, 247.)

312.—DITREMA Schlegel.

Surf-fishes.

(*Embiotoca* Agassiz: *Phanerodon* Girard: *Tæniotoca* Alex. Agassiz.)

(Schlegel, Fauna Japon. Poiss. 77, 1850: type *Ditrema temmincki* Bleeker, from Japan.)

Body oblong, compressed, more or less elevated, with the caudal peduncle robust or rather slender. Head moderate, lower jaw included. Lips moderate, the lower with a frenum. Maxillary short, its whole length slipping under the preorbital. Teeth few, conical, bluntish, in one series. Gill-rakers weak, rather short and slender. Pharyngeals normal. Caudal fin lunate or forked; anal fin rather long, much longer than abdomen, its spines small. Scales small, about 60 in the lateral line. Species 5, differing in external appearance, but alike in essential characters. The Japanese type of this genus is closely related to *Ditrema atripes*. (δισ, two; τρῆμα, aperture.)

a. Caudal peduncle stout, the fin not widely forked. (*Embiotoca** Agassiz.)

935. D. laterale (Agassiz) Gthr.—*Blue Perch; Surf-fish.*

Color reddish olive above, becoming bright orange red below, everywhere thickly dusted with black points; a continuous bright blue streak along the edges of each row of scales; streaks of thoracic region formed by isolated blue spots on the middle of the scales; head with several series of blue spots and streaks; fins all olivaceous dusky; ventrals with some light orange. Body oblong, compressed, with a short and very high caudal peduncle, the body tapering backward less than usual.

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*Agassiz, Amer. Journ. Sci. Arts, 1853, 387: type *Embiotoca jacksoni* Ag. (εμβιος, life within; τόκος, offspring.)

Mouth but little oblique, the maxillary scarcely reaching orbit. Teeth strong. Spinous dorsal very low, the last spine highest, but much shorter than the soft rays; soft dorsal and anal high. D. X or XI, 23; A. III, 31; Lat. l. 63; Vert. 15 + 19. L. 15 inches. Pacific coast of the United States; everywhere very abundant.

(*Embiotoca lateralis* Agassiz, Amer. Journ. Sci. Arts, 1854, 366: *Tæniotoca lateralis* Alex. Agassiz, Proc. Bost. Soc. Nat. Hist. 1861, 133: *Embiotoca lineata, ornata,* and *perspicabilis* Girard, U. S. Pac. R. R. Surv. Fish.; Günther, iv, 245.)

936. D. jacksoni (Agassiz) Günther.—*Surf-fish; Croaker; Black Perch.*

Brownish, tinged with green, blue, red, or yellowish; sides with about 10 faint vertical dusky bars; belly usually yellowish; head with blue spots; fins dusky, tinged with blue or red; anal in males sometimes red with a black patch, and the ventrals orange. Colors extremely variable, the pattern of color not definite. Form ovate, rather thick, the outlines convex. Mouth rather small. Dorsal spines low, much lower than the soft rays; caudal peduncle thickish, the fin not widely forked. Scales on cheeks in 4 series. Head $3\frac{1}{4}$; depth 2. D. IX or X, 20; A. III, 25; Lat. l. 58. L. 1 foot. Pacific coast of the United States; the most abundant of the larger species southward.

(*Embiotoca jacksoni* Agassiz, Amer. Journ. Sci. Arts, 1853, 387, and 1854, 366: *Embiotoca jacksoni* Girard, U. S. Pac. R. R. Surv. Fish. 168; Günther, iv, 245: *Embiotoca cassidii* and *E. webbi* Girard, U. S. Pac. R. R. Surv. Fish. 171, 173.)

aa. Caudal peduncle slender, the fin widely forked. (*Phanerodon* Girard.*)

b. Ventral fins blackish at tip.

937. D. atripes Jordan & Gilbert.

Light olivaceous above, pearly below; scales above the axis of body each with an orange spot at base, its outer margin tinged with blue, these forming faint reddish streaks along the rows of scales; anal with a dusky spot; ventrals broadly tipped with blackish; caudal not dark-edged. Body elongate, tapering into a long and slender caudal peduncle. Snout rather projecting. Head small. Mouth small, the maxillary not extending to opposite the eye. Teeth few and small. Eye as long as snout, $3\frac{1}{2}$ in head. Cheeks with 3 rows of scales. Gill-rakers longer than in related species, and pharyngeals stronger, with the teeth more nearly paved. Highest dorsal spine shorter than the soft rays. Pectorals long, reaching tip of ventrals. Caudal lobes equal. Head $3\frac{1}{2}$; depth $2\frac{1}{2}$. D. X, 23; A. III, 29; Lat. l. 70. L. 10 inches. Monterey Bay; locally abundant.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 320.)

bb. Ventral fins colorless.

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* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 153: type *Phanerodon furcatus* Grd. (φανερος, visible; οδων, tooth.)

938. D. furcatum (Grd.) Günther.

Light olivaceous, silvery below, sometimes yellowish; scales with bright reflections, but no red markings; usually a round dusky spot on the anal; ventrals plain; caudal fin edged behind with dusky; fins usually yellowish tinged. Body oblong-elliptical, compressed, tapering backward into the long and slender caudal peduncle; mouth small; teeth rather large, conical; gill-rakers very short and slender; last dorsal spine highest, sometimes higher than the soft rays, the fin higher than in *D. atripes;* caudal fin strongly forked, the upper lobe usually the longer. Head $3\frac{3}{4}$; depth $2\frac{1}{2}$; D. X, 24; A. III, 32; Lat. l. 66. L. 1 foot. Coast of California; extremely abundant from Cape Mendocino southward.

(*Phanerodon furcatus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 163, and in U. S. Pac. R. R. Surv. Fish. 184; Günther, iv, 247.)

313.—RHACOCHILUS Agassiz.

(Agassiz, Am. Journ. Sci. Arts 1854, 367: type *Rhacochilus toxotes* Agassiz.)

Body ovate, compressed, tapering abruptly into a long and robust caudal peduncle; mouth comparatively large, the lower jaw included; lips extremely thick, the lower without frenum, its posterior free edge coarsely lobed; teeth few, small, conical, in one series; gill-rakers rather long; pharyngeals normal; scales small; dorsal spines low, posteriorly subequal, much shorter than the soft rays; caudal deeply forked; anal basis elongate, the spines small. Vertebræ 14 + 22. The genus differs from *Ditrema* chiefly in the development of the lips. (*ῥάχος*, ragged; *χεῖλος*, lip.)

939. R. toxotes Agassiz.—*Alfione.*

Olivaceous, with brassy reflections and dusky points; fins plain; body ovate, with elevated back and long, thick caudal peduncle; head deep, with prominent snout; mouth wide, oblique; maxillary reaching front of orbit, slipping under the preorbital; lips extremely large, with uneven surface; teeth strong, wide-set, those in mandible little developed; eye large. Soft dorsal considerably elevated, much higher than spinous portion; pectorals and ventrals long; caudal short, deeply forked, the upper lobe the longer. Head $3\frac{2}{5}$; depth $2\frac{2}{5}$. D. X, 23; A. III, 30; Lat. l. 76. L. 18 inches. The largest and least handsome of the family, and the one of most value as food. Coast of California; rather common.

(Agassiz, Am. Journ. Sci. Arts, 1854, 367; Girard, U. S. Pac. R. R. Surv. Fish. 188: *Ditrema toxotes* Günther, iv, 247.)

314.—DAMALICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1855, 321: type *Damalichthys vacca* Girard.)

Body ovate, compressed, with long caudal peduncle. Head rather large. Mouth moderate, the lower jaw included. Lips full, the lower with a frenum. Teeth very few, short, conical, bluntish, in one series. Gill-rakers short and slender. Lower pharyngeal very large, convex behind in outline, with the lateral horns very short and thick. Anterior tooth-bearing area on the plane of the bone; posterior area inclined backward, forming a steep angle with the anterior part; teeth on anterior part low, truncate, hexagonal, tessellated; on posterior part ovate, flattened, imbricated, and turned forward so that the posterior side forms the grinding edge. Scales rather small. Dorsal spines low, much shorter than the soft rays. Anal fin long, with small spines. Vertebræ 13 + 21. Species of large size, plainly colored, externally resembling *Ditrema*, but singularly distinguished from all the other members of the family by the peculiar pharyngeals. (δάμαλίς, calf; ἰχθύς, fish; in allusion to its viviparity.)

940. D. argyrosomus (Girard) J. & G.—*White Perch; Porgee.*

Color soiled white, with silvery lustre; three or four obscure dusky bars, most distinct in the young; fins nearly plain, dusky. Form broadly elliptical, the dorsal curve regular; caudal peduncle rather slender. Head not blunt; premaxillary just below the level of the pupil, the maxillary scarcely reaching front of eye. Lips thickish, even. Cheeks with 3 or 4 rows of scales. Gill-rakers not $\frac{1}{4}$ so long as the large eye, which is longer than snout. Teeth very few, short and blunt. Dorsal spines stoutish, the last one highest, half the height of the soft rays. Caudal deeply forked, the upper lobe the longer. Pectoral long. Head $3\frac{1}{3}$; depth $2\frac{1}{3}$. D. X, 23; A, III, 29; Lat. l. 63. L. 15 inches. Pacific coast of United States, north to Vancouver's Island; very abundant northward.

(*Embiotoca argyrosoma* Grd. Proc. Acad. Nat. Sci. Phila. 1855, 136, and in U. S. Pac. R. R. Surv. Fish. 180: *Damalichthys vacca* Girard, Proc. Acad. Nat. Sci. Phila. 1855, 321, and in U. S. Pac. R. R. Surv. Fish. 182: *Ditrema vacca* Günther, iv, 246.)

Family XCIV.—LABRIDÆ.

(*The Wrasse-fishes.*)

Body oblong or elongate, covered with cycloid scales; lateral line continuous or interrupted, often angularly bent. Mouth moderate,

terminal; premaxillaries protractile; maxillaries without supplemental bone, slipping under the membranaceous edge of preorbital; the anterior teeth in the jaws usually very strong; teeth of the jaws separate or more or less soldered together, sometimes forming a continuous plate; no teeth on vomer or palatines; lower pharyngeals completely united into one bone, without median suture. Lips thick, longitudinally plicate. Nostrils round, with two openings on each side. Dorsal fin continuous, the spinous portion long; anal similar to soft dorsal, usually with two or three spines. Ventrals thoracic, I, 5. Branchiostegals 5–6. Pseudobranchiæ present. Gills $3\frac{1}{2}$; the slit behind the last arch small or obsolete; the gill-membranes somewhat connected, often joined to the narrow isthmus. Air-bladder present. No pyloric cœca. Genera 65, species 450, chiefly of the tropical seas. Many of them are brilliantly colored, and some are valued as food-fish. Most of them feed upon mollusks, the dentition being adapted for crushing shells. The group has been much subdivided, and many of the current genera are distinguished by characters of little importance.

(*Labridæ* Günther, iv, 65–244.)

a. Teeth in jaws distinct; pharyngeal teeth not confluent; anal spines 3.

b. Dorsal fin with 15–20 spines; teeth all conical; no posterior canines; lateral line continuous. (*Labrinæ.*)

c. Preopercle serrate; cheeks and opercles scaly; teeth in a band, the outer enlarged ..... CTENOLABRUS, 315.

cc. Preopercle entire; cheeks scaly; opercles naked; teeth in about two series. TAUTOGA, 316.

ccc. Preopercle entire; cheeks and opercles scaly; teeth in a single series. LACHNOLÆMUS, 317.

bb. Dorsal fin with 8–13 spines. (*Julidinæ.*)

d. Lateral line continuous.

e. Cheeks and opercles scaly; dorsal spines 12; posterior canines present. HARPE, 318.

ee. Cheeks and opercles naked or very nearly so; dorsal spines 9.

f. Posterior canines well developed ..... PLATYGLOSSUS, 319.

ff. Posterior canines obsolete ..... PSEUDOJULIS, 320.

dd. Lateral line interrupted; head naked, its upper edge usually trenchant. XYRICHTHYS, 321.

aa. Teeth in jaws confluent; pharyngeal teeth pavement-like; anal spines 2; scales large. (*Scarinæ.*)

g. Teeth partly separate, the anterior distinct; dorsal spines flexible. CALLIODON, 322.

gg. Teeth soldered together, forming a plate like the jaw of *Tetrodon;* each jaw divided on the median line; dorsal spines flexible; scales on cheeks in two or more rows ..... HEMISTOMA, 323.

315.—CTENOLABRUS Cuvier & Valenciennes.

Cunners.

(Cuv. et Val. Hist. Nat. Poiss. xiii, 223, 1839: type *Labrus rupestris* L. of Europe.)

Body oblong, not elevated, comparatively slender and compressed. Head moderate, more or less pointed. Teeth in the jaws in several series, the outermost very strong; the teeth unequal, conical, and pointed; no posterior canines. Cheeks with small scales; opercles with large ones. Preopercle with the vertical limb finely serrated. Branchiostegals 5. Gill-membranes considerably united, free from the isthmus; gill-rakers short. Scales moderate, 35–50 in the lateral line; lateral line continuous, abruptly bent opposite posterior part of second dorsal. Dorsal long and low, the spinous portion much longer than the soft, of 16–18 low, subequal, rather strong spines; soft dorsal slightly elevated; anal fin similar to soft dorsal, with three strong graduated spines; caudal truncate; pectorals short, the ventrals inserted behind their axils. (κτεις, κτενός, a comb; *Labrus*, a related genus, from the Latin *labrum*, lip.)

a. Interopercle naked. (*Tautogolabrus* Günther.*)

941. C. adspersus (Walb.) Goode.—*Cunner; Chogset; Blue Perch.*

Brownish blue, with more or less of a brassy lustre; colors variable; young variegated and with a black blotch on the dorsal fin. Eye moderate, broader than preorbital, 4½ in head. Head 3½ in length; depth 3. D. XVIII, 10; A. III, 9; Lat. l. 45. L. 12 inches. Newfoundland to Cape Hatteras; common northward, about rocks.

(*Labrus adspersus* Walbaum, Artedi, Pisc. 1792, 254: *Ctenolabrus burgall* Günther, iv, 90: *Ctenolabrus cæruleus* Storer, Hist. Fish Mass. 234.)

316.—TAUTOGA Mitchill.

Tautogs.

(Mitchill, Report Fish New York, 1814, 23: type *Labrus tautoga* Mitchill = *Tautoga nigra* Mitchill = *Labrus onitis* L.)

Body oblong, not elevated nor greatly compressed. Head large, nearly as deep as long, with a convex profile. Mouth rather small. Teeth very strong, conical, in two series; the outer somewhat incisor-like; the two anterior teeth in each jaw strong; the posterior teeth small, without canines. Eye small, high up. Cheeks with small scales.

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*Günther, Cat. Fish. Brit. Mus. iv, 90: type *Labrus burgall* Bloch and Schneider: [*Tautoga; Labrus.*]

Opercles naked, except above. Scales on body rather small, in about 60 transverse series, those on ventral region reduced in size. Lateral line continuous, abruptly decurved opposite the end of the soft dorsal. Dorsal fin long, low, continuous, the spinous part much the longer, with about 16 low, strong, subequal spines, each with a small cutaneous appendage at tip; soft dorsal higher than spinous; anal similar to soft dorsal, with three stout, graduated spines; pectorals broad and rather short; caudal short, truncate, with rounded angles; the soft parts of the vertical fins with the membranes somewhat scaly; ventrals conspicuously behind pectorals. Branchiostegals 5. Gill-rakers very short and feeble; gill-membranes somewhat connected, free from the isthmus. A single species known. (A latinization of the vernacular name "Tautog," which is of Indian origin.)

942. T. onitis (L.) Gthr.—*Tautog; Black-fish; Oyster-fish.*

Blackish; young greenish, with about three pairs of irregular chain-like bars, the sides sometimes reticulated; chin white. Pectorals short, rounded, not reaching the tips of the short ventrals. Head $3\frac{1}{4}$ in length; depth 3. D. XVI, 10; A. III, 8; Lat. l. 60. Maine to South Carolina; a common food-fish.

(*Labrus onitis* Linn. Syst. Nat.; Günther, iv, 88: *Tautoga americana* Storer, Hist. Fish. Mass. 276.)

317.—LACHNOLÆMUS Cuvier & Valenciennes.

Hog-fishes.

(Cuv. & Val. Hist. Nat. Poiss. xiii, 274, 1839: type *Lachnolæmus aigula* C. & V. = *Labrus falcatus* L.)

Body strongly compressed, the back sharp and elevated, the profile long and steep. Snout sharp. Mouth low, horizontal, the jaws narrow; premaxillary slipping under the membranaceous edge of the very broad preorbital, which is twice the depth of the eye. Teeth in front prominent, canine-like, in a single series; no posterior canines. Cheeks and opercles with imbricate scales. Scales of moderate size, thin, adherent. Lateral line complete. Dorsal with fourteen spines, the first three strong, falcate, produced in long streamers in the adult, the membranes between these spines very low, the filamentous tips longer than the head; other spines all low, gradually shorter to the eleventh; second dorsal and anal much produced; caudal lobes falcate; third anal spine strong; pectorals and ventrals short. One species known. (λάχνη, velvety; λαιμός, throat, the pharyngeal bones being only partly provided with teeth, and the rest of their surface covered with a velvety membrane.)

943. L. falcatus (L.) C. & V.—*Hog-fish; Aigrette; Capitaine.*

Chiefly red; a jet black spot usually present at base of soft dorsal; ventrals dusky; cheeks with 4 rows of scales. Ventrals reaching beyond tips of pectorals. Head 3; depth $2\frac{1}{4}$; scales 8–40–19; vert. 12 + 17. L. 14 inches. West Indies, north to Florida; abundant. An excellent food-fish; varies much with age.

(*Labrus falcatus* L. Syst. Nat. i, 475: *Lachnolæmus falcatus, aigula, dux, suillus, caninus,* and *psittacus* C. & V. xiii, 277–291; Günther, iv, 87; Goode, Bull. U. S. Nat. Mus. v, 36, 1876.)

318.—HARPE Lacépède.

Lady-fishes.

(*Cossyphus* Cuv. & Val.; preoccupied: *Trochocopus* Günther: *Pimelometopon* Gill.)

(Lacépède, Hist. Nat. Poiss, iv, 426, 1802: type *Harpe cæruleo-aureus* Lac. = *Labrus rufus* L.)

Body oblong, moderately compressed, covered with firm scales of varying size, 25 to 60 in the course of the lateral line, which is continuous. Head rather pointed in the young, becoming very deep and convex in the adult from the development of the adipose tissue on the top of the head. Opercle, subopercle, interopercle, and cheeks scaly, preopercle naked; preopercle minutely serrulate or entire. Jaws each with four strong, conical, somewhat compressed canines in front, the lateral teeth similar, but much smaller, coalescent at base with each other, and with small granular teeth, so that the surface of the jaws is bony; upper jaw with strong posterior canines, directed forwards. Dorsal fin with about twelve low spines, its soft portion scaly at base or naked; anal with three spines, the spines rather strong; lobes of soft dorsal, anal and caudal more or less produced in the adult; ventrals inserted directly below pectorals. Gill-membranes slightly connected. Coarse, brightly-colored fishes, inhabiting tropical seas. (ἅρπη, scythe; in allusion to the falcate fins.)

a. Base of dorsal scaly; scales rather large; vertical fins with falcate lobes. (*Harpe.*)

944. H. rufa (L.) Gill.—*Lady-fish; Doncella.*

Head and upper half of body anteriorly rich chestnut brown; remainder, including lower half of operculum, bright golden yellow. Snout pointed, its length more than one-third that of the head. Head longer than high. Upper lip thick, with conspicuous folds; preoperculum denticulate. Two outer ventral rays and lobes of soft dorsal, anal and caudal much produced; the long rays of the dorsal and anal extending to the middle of the median caudal rays, the outer caudal

rays twice as long as the median. (*Goode.*) D. XII, 10; A. III, 11; scales 5–32–13. West Indies, north to Florida Keys.

(*Labrus rufus* L. Syst. Nat. i, 284: *Cossyphus rufus* Günther, iv, 108; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 222; Goode, Bull. U. S. Nat. Mus. v, 37: *Cossyphus bodianus* Cuv. & Val. xii, 103: *Bodianus rufus* Poey, Rep. Fis. Nat. Cuba, ii, 331.)

aa. Base of dorsal not scaly; scales rather small; vertical fins little produced. (*Pimelometopon** Gill.)

945. H. pulchra (Ayres) J. & G.—*Red-fish; Fat-head.*

Males with the head, dorsal, anal, and caudal fins, and the posterior part of the body, as far as the vent, purplish black; middle part of the body, pectoral fin, middle of caudal, and posterior edge of dorsal red, varying in tint from clear crimson to blackish, with coppery or purplish lustre; region about shoulder-girdle reddest; lower jaw in both sexes abruptly and entirely white; females dusky rose-colored, with the black areas ill defined or obsolete. Forehead in the adult with a very prominent fatty hump. Gill-rakers short, thickish. Caudal fin truncate, the lobes in the adult produced and pointed. Scales on breast small; preopercle serrulate in young. Head $3\frac{1}{3}$; depth 3. D. XII, 10; A. III, 12; Lat. l. 62. L. 30 inches. Coast of California, from Point Concepcion southwards; very abundant. Dried in immense numbers by the Chinese.

(*Labrus pulcher* Ayres, Proc. Cal. Acad. Nat. Sci. i, 3, 1854: *Semicossyphus pulcher* Günther, iv, 99; *Pimelometopon pulcher* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 59.)

319.—PLATYGLOSSUS Bleeker.

Doncellas.

(*Halichœres* Ruppell, preoccupied: *Chœrojulis* Gill.)

(Klein; Bleeker, Proc. Zoöl. Soc. Lond. 1861, 411: type *Julis annularis* C. & V.)

Body oblong, compressed, not elevated, covered with large scales, there being 25–30 in the course of the lateral line, which is not interrupted, but abruptly bent posteriorly. Scales on breast rather smaller. Head naked, compressed, conic. Preopercle entire. Teeth large, each jaw with two to four canines in front, none of them bent backwards; a posterior canine tooth directed forwards on each side of the upper jaw. Dorsal spines nine; anal spines three, graduated; ventrals inserted under axil of pectoral. Gill-rakers short and feeble; gill-membranes slightly joined to a narrow isthmus. Species numerous, brilliantly colored, abounding in kelp in the tropical seas. ($\pi\lambda\alpha\tau\upsilon\varsigma$, broad; $\gamma\lambda\omega\sigma\sigma\alpha$, tongue; an old name without evident application.)

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*Gill, Proc. Acad. Nat. Sci. Phila. 1864, 58: type *Labrus pulcher* Ayres. ($\pi\iota\mu\varepsilon\lambda o\varsigma$, fat; $\mu\varepsilon\tau o\pi o\nu$, forehead.)

946. P. radiatus (L.) J. & G.—*Blue-fish; Doncella.*

Adult brilliant azure-blue, each scale edged with bright pearly green; a longitudinal blue band on anal; margin of dorsal light blue; young ("*cyanostigma*") brownish, a light-blue spot on the base of each scale; head with spots and stripes of bright blue; dorsal with 4 lines of stripes and blotches and a broad edge of blue; caudal with a broad white margin, the outer rays blue, the base of the fin spotted with blue; anal with border and two longitudinal stripes of blue, besides a blue spot at the base of each ray; pectoral with first 5 rays and a transverse line blue. Head 4; depth 3. D. IX, 11; A. III, 12; scales 2–28–10. L. 16 inches. West Indies, north to Key West.

(*Sparus radiatus* Linnæus, Syst. Nat. xii, 472, 1766: *Julis cyanostigma, principis,* and *patatus* Cuv. & Val. xiii, 391–398: *Platyglossus cyanostigma* Günther, iv, 161: *Platyglossus principis* Günther, iv, 164: *Chœrojulis radiatus* Goode, Bull. U. S. Nat. Mus. v, 35.)

947. P. grandisquamis (Gill) J. & G.

Color, in spirits, dark chestnut or brownish red; a very dark vertical spot bordered by steel-blue, behind the opercle; anal fin faintly barred; caudal marbled, and with a marginal dark band. Body rather short and stout. Profile slightly convex. Maxillary nearly reaching front of orbit. Dorsal spines short, rather stiff. Caudal fin subtruncated. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. IX, 11; A. III, 12; Lat. l. 27. Beaufort, N. C.

(*Chœrojulis grandisquamis* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 206.)

948. P. humeralis (Poey) Gthr

A black spot, edged with pearl color posteriorly, on the extremity of the operculum; a brown band from the snout through the eye and the opercular spot across the bend of the lateral line to the base of the caudal; a second from below the axil along the side of the belly; a bluish streak, edged with darker, from the eye obliquely upward and backward, meeting its fellow on the nape; base of pectoral whitish, without black spot; caudal truncate, with blue angles. A black band along the middle of the dorsal fin is described by Dr. Günther, but is wanting in the specimens seen by us. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. D. IX, 11; A. III, 11; scales 2–29–10. Coast of Cuba, north to Florida.

(*Julis humeralis* Poey, Mem. Cuba, ii, 212, 1858; Günther, iv, 165: *Chœrojulis humeralis* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 338.)

949. P. semicinctus (Ayres) Günther.—*Kelp-fish.*

Dark greenish brown, with bright reflections; head bronze-green above; three or four narrow, horizontal, wavy blue bands below the

eye, alternating with bronze. Just above middle of body, close behind the pectorals, in the males, is a deep indigo-blue cross band, which nearly meets its fellow under the belly. Pectorals yellow, upper edge of axil black; ventrals cream-color, each reaching beyond the posterior edge of the blue cross-band; other fins with horizontal, wavy, reddish streaks; female without blue band, but with irregular ink-like spots on numerous scales on the back and tail. Body oblong, compressed, rather elevated at the nape. Lips thick, the lower with a frenum. Teeth in about two series; three or four of the anterior in each jaw, canine-like. Eye small. Dorsal spines slender, low, and flexible. Scales on breast small. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D IX, 12; A. III, 12; Lat. l. 28. Pacific coast, north to Point Concepcion, not rare southward.

(*Julis semicinctus* Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 32; Günther, iv, 161; Steindachner, Ichthyol. Beiträge, v, 151, 1876.)

320.—PSEUDOJULIS Bleeker.

Señoritas.

(Bleeker, Proc. Zoöl. Soc. London, 1861, 412: type *Julis girardi* Bleeker.)

This genus differs from *Platyglossus* only in the lack of development of the posterior canines, which are either wanting altogether or reduced to a slight rudiment. (ψεῦδος, false; ἰουλος, Julis, an allied genus.)

a. Dorsal spines very slender and flexible. (*Oxyjulis** Gill.)

950. P. modestus (Grd.) Gthr.—*Señorita; Pesce Rey.*

Olive-brown, the scales each with orange-brown in the centre; cream-color below; sides of head with alternating horizontal streaks of bluish and brown; a dark blue spot at base of pectoral above; membrane of base of spinous dorsal largely indigo-blue; a large inky blotch at base of caudal, covering one-third the fin; fins otherwise light brown. Body elongate, the back not elevated, the head slender and sharp. A small posterior canine sometimes present on one side, usually entirely wanting. Fins low; ventrals short; caudal truncate; spines weak and slender; pectorals reaching beyond tips of ventrals. Head 4; depth $4\frac{1}{2}$. D. IX, 13; A. III, 13; Lat. l. 28. L. 7 inches. Pacific coast; abundant southward. A graceful little fish.

(*Julis modestus* Girard, U. S. Pac. R. R. Surv. Fish. 1858, 163; Günther, iv, 168: *Oxyjulis modestus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 142.)

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*Gill, Proc. Acad. Nat. Sci. Phila. 1862, 142: type *Julis modestus* Ayres.

321.—XYRICHTHYS Cuvier & Valenciennes.

Razor-fishes.

(Cuv. & Val. Hist. Nat. Poiss. xiv, 33, 1839: type *Coryphæna novacula* L.)

Body oblong, compressed, deepest behind the occiput, thence tapering backward. Head very short and deep; the profile almost vertical; the upper and anterior outlines compressed to an edge, at least in typical species. Preorbital very deep. Eyes high, near the top of the head. Mouth small, low. No posterior canines. Cheeks and opercles naked, or with only a few very small scales below the eye. Scales large, with membranaceous edges; less than thirty in a longitudinal series; lateral line interrupted behind, commencing again lower down on the caudal peduncle. Dorsal fin continuous, with nine spines. Colors brilliant. Tropical seas. (ξυρὸν, razor; ἰχθύς, fish.)

951. X. vermiculatus Poey.

Head greenish, tinged with orange on the side; seven or eight blue stripes along the cheeks; three on the opercles; body brownish, paler below; each scale with a blue vertical band and sometimes some blue spots; toward the end of the pectoral is a broad violet band on the sides; dorsal and anal carmine-red with blue vertical lines, paler on the front of the dorsal; caudal blue, with vermilion bands; pectorals white; ventrals rosy. Head very short, deeper than long, the front compressed, sharp, almost vertical. Preorbital very deep, its depth half the length of the head. Eye small, placed very high, its distance from the profile scarcely greater than its diameter; four small scales below the eye. Two canines in front of each jaw. Dorsal spines low, flexible; ventrals rather long; pectorals short. Head 4; depth $3\frac{1}{2}$. D. IX, 12; A. III, 11; scales 2–27–8. West Indies, north to Key West, Fla.; very similar to the European *X. novacula* (L.) Cuv. & Val., if not identical with it.

(Poey Memorias Cuba, ii, 215, 1858.)

952. X. lineatus Cuv. & Val.—*Razor-fish.*

Rose-red; a large oblong blotch on each side of the belly, below the pectorals; narrow lines descend from these blotches, meeting on the belly. The two anterior dorsal spines flexible, not produced. Outer ventral ray prolonged, not reaching vent. D. IX, 12; A. III, 12; Lat. l. 25. (*Günther.*) West Indies; occasional on our Southern coasts.

(Cuvier & Valenciennes, xiv, 50, 1839: *Novacula lineata* Günther, iv, 171.)

322.—CALLIODON Gronow.

(Gronow; Bloch & Schneider, Syst. Ichth. 1801, 312: type *Calliodon lineatus* Bloch & Schneider.)

Body moderately elongate, compressed, covered with large scales. Lateral line complete, its branching tubes covering the surface of its scales. Teeth at base coalescent with the bony jaw, the tips free; no median division in either jaw; upper jaw with canine-like teeth in front; posterior canines present; lower pharyngeal bone large, broader than long; the teeth coalescing, forming a pavement. One row of large scales on the cheek. Dorsal spines flexible. D. IX, 9 or 10; A. II, 8; scales about 2–24–6. Tropical seas. (καλὸς, beautiful; ὀδὼν, tooth.)

953. C. ustus Cuv. & Val.

Reddish in spirits, nearly plain, a black spot behind the first dorsal spine. Body moderately elongated, compressed. Head rather pointed. Upper jaw with 6 canines in front, free at their tips, coalescent below; no smaller teeth behind these; posterior canine well developed, directed outward and partly backward; between the anterior and posterior canines a series of small teeth behind the sharp edge of the bone. Lower jaw with a series of close-set, even, bluntish teeth, coalescing below; upper lip double for its whole length, covering all of the upper jaw except the tips of the teeth. Opercles with two rows of scales, larger than those on the cheeks. Dorsal spines moderately high, very slender; pectoral short, rounded; caudal truncate. D. IX, 9; A. II, 8; scales 1½–24–6. West Indies, occasional northward. This description taken from a specimen obtained at Charleston by Mr. R. E. Earll.

(Cuv. & Val. xiv, 286, 1839; Günther, iv, 214.)

323.—HEMISTOMA Swainson.

Parrot-fishes.

Pseudoscarus Bleeker.

(Swainson, Class'n. Anim. ii, 1839, 226: type *Scarus pepo* Bennett.)

Body oblong, more or less compressed, covered with very large scales. Lateral line continuous. Lower jaw included; teeth in each jaw soldered together, forming a continuous plate, divided by a median suture as in *Tetrodon;* the separate teeth traceable by serrations on the edge and by reticulated markings on the anterior surface; none of them exserted; posterior canines small or wanting; lower pharyngeal very large, longer than broad, the teeth paved. Scales on the cheek in more than one series. Dorsal spines flexible; dorsal IX, 10, or X, 9;

anal II, 8, or 9. About 24 scales in the lateral line. Tropical seas. Large fishes of the tropical seas, brilliantly colored, little valued as food. Many species occur in the West Indies, any of which may be found about the Florida Keys. The closely related genus *Scarus* Forskål, distinguished chiefly by the stiff spines of the dorsal fin, occurs in the same waters, and several of its species may be looked for on our coast. (ἥμι, half; στόμα, mouth; the jaws divided.)

954. H. guacamaia (Cuv. & Val.) J. & G.

Brownish, the jaws and naked parts of the head green; fins dark, the margin of the dorsal, anal, and ventrals green. Upper lip thick, covering more than half of the plate of the jaw; lower lip full; no posterior canine teeth. A single scale on the lower limb of the preopercle, besides the two series of scales on the cheek; opercle with two rows of scales; top of head scaled forwards to the eyes. Eye small, about midway in head. Dorsal fin not emarginate; anal spines long and flexible; caudal shortish, double truncate; pectorals short. Lateral line abruptly decurved posteriorly. Head 3; depth 3. D. X, 9; A. II, 9; Lat. l. 23. West Indies, north to Key West, Fla.

(*Scarus guacamaia* Cuv. & Val. xiv, 178, 1839: *Pseudoscarus guacamaia* Günther, iv, 233.)

Family XCV.—CICHLIDÆ.

(*The Cichlids.*)

Fresh-water Labroids. Body elevated, oblong or elongate, covered with moderate-sized scales, which are usually ctenoid. Lateral line interrupted, usually ceasing opposite the posterior part of the dorsal, and then recommencing lower down on the caudal peduncle. Mouth varying in size, terminal, the jaws with rather small teeth, which are usually conical, but sometimes lobate or incisor-like; no teeth on vomer or palatines. Nostril single on each side. Premaxillaries freely protractile; maxillary slipping under the broad preorbital. Gill-rakers various; gill-membranes often connected. Dorsal fin single, with the spinous portion well developed, usually rather longer than the soft portion; anal fin with 3 or more spines, the soft part similar to the soft dorsal; ventral fins thoracic, I, 5. Lower pharyngeal bones united into a triangular piece, with a median suture. Branchiostegals 5 or 6; no pseudobranchiæ. Gills 4; a slit behind the fourth. Air-bladder present. A large family of fresh-water fishes of moderate or small size, representing, as to form, size, appearance, and habits, and even as to many details of structure, in the waters of South America, the *Cen-*

trarchidæ of the United States. Genera about 25; species about 120, inhabiting the rivers of Africa and tropical America, the genus *Heros* extending into the limits of the United States. Those with lobate teeth are herbivorous, the rest carnivorous.

(*Chromides* Günther, iv, 264–316.)

* Spinous part of dorsal longer than the soft; gill-rakers short and thick; teeth conical; body ovate or oblong, covered with ctenoid scales; anal spines 5 or more; mouth rather small ..... HEROS, 327.

324.—HEROS Heckel.

(*Herichthys* Baird & Girard.)

(Heckel, Brazil, Fluss-fische, Ann. Wien. Mus. ii, 362, 1840: type *Heros severus* Heckel.)

Body oblong, compressed, somewhat elevated, the form Centrarchoid. Head rather large, scaly on the cheeks and opercles; preopercle entire. Mouth rather small, terminal, low, the jaws equal; maxillary small; preorbital deep; jaws with a single series of rather stout conical teeth, behind which, in front, is a narrow band of villiform teeth. Gill-membranes slightly connected, free from the isthmus; gill-rakers short and thick. Scales rather large, ctenoid; the lateral line interrupted and beginning again below, as usual in this family. Dorsal fin continuous, the spinous part much longer than the soft part, of about 17 rather low but strong spines; soft rays much higher than spines; anal fin similar to soft dorsal but shorter, its spinous part also longer than the soft, of about 6 spines; caudal fin subtruncate, with rounded angles. Species very numerous in Central and South America. (ἥρως, hero; the application not evident.)

955. H. cyanoguttatus (B. & G.) Gthr.

Brownish, body and soft parts of vertical fins everywhere with small blue spots; sometimes a black spot on middle of spinous dorsal, with another one below it on the back; a black blotch at base of caudal. Body oval, moderately compressed; profile gently curved; interorbital region slightly depressed; eyes small, situated rather backward and high up; mouth small, maxillary not reaching orbit; six rows of scales on cheek; fins high. Head $3\frac{1}{4}$; depth $2\frac{1}{6}$. D. XVII, 10; A. VI, 8. Lat. l. 25. Rivers of Texas and Mexico.

(*Herichthys cyanoguttatus* B. & G. Proc. Acad. Nat. Sci. Phila. vii, 25, 1854: Günther, iv, 290.)

Family XCVI.—POMACENTRIDÆ.

(*The Pomacentroids.*)

Labroid fishes with the body short, deep, compressed, covered with ctenoid scales; lateral line wanting posteriorly; mouth moderate, usually with rather strong teeth; vomer and palatines toothless; nostril single on each side,* nearly round; preopercle with its posterior edge largely free; dorsal fin single, with the spinous portion longer than the soft, which is similar to the soft anal; anal spines 2; ventral fins thoracic, I, 5, the anterior rays longest. Lower pharyngeals fully united; branchiostegals 5–7; gills $3\frac{1}{2}$; slit behind the last gill very small or obsolete; no labyrinthiform appendage; air-bladder and pseudobranchiæ present; gill-membranes free from the isthmus. Vertebræ 12 + 14.

Fishes of the tropical seas, similar in mode of life to the *Chætodontidæ*, feeding on small marine animals and plants in the coral reefs. Genera 10; species about 160.

(*Pomacentridæ* Günther, iv, 2–64.)

a. Teeth incisor-like, fixed, in one series ..... Pomacentrus, 325.
aa. Teeth conical, in 2 or more series ..... Chromis, 326.

325.—POMACENTRUS Lacépède.

Demoiselles.

(*Glyphidodon* Lac.: *Hypsypops*, *Pomataprion*, and *Euschistodus* Gill.)

(Lacépède, Hist. Nat. Poiss. iv, 508, 1802: type *Chætodon pavo* Bloch.)

Body ovate, deep and compressed; the profile steep. Head moderate, nearly as deep as long, almost everywhere scaly. Mouth quite small, terminal; the jaws equal; both jaws armed with a single series of compressed teeth, notched or not, immovable. Gill-rakers long; preopercle entire, or more or less serrate; preorbital serrate or entire. Scales large, strongly ctenoid, the lateral line running parallel with the back to near the end of the dorsal fin, at which point it ceases. Dorsal fin continuous, with 12 or 13 low stout spines; the soft part more or less elevated, its last rays gradually shortened; anal fin similar to soft dorsal, with two spines, of which the second is much the larger; dorsal spines with a sheath of large scales, the membranes of both dorsal and anal covered high up with small scales; caudal fin

*As in the *Cichlidæ*. All other *Acanthopteri* have two nasal openings on each side.

deeply forked. Branchiostegals 5 or 6. Species numerous in the tropical seas. (*πῶμα*, operculum; *κεντρον*, spine.)

a. Preopercle serrate, at least in the adult. (*Pomacentrus.*)

956. P. leucostictus Müller & Troschel.

Dark brownish above, yellowish green on the sides and belly, yellow on the tail and caudal fin; numerous roundish bluish-white spots on the head, back, and soft portions of the dorsal and anal fins, the dots being less numerous on the sides; sometimes nearly uniform brown, almost unspotted; no spot on the back of the tail; a white dot on the base of the last anal rays; young with an ocellated dorsal spot and convergent blue bands on the snout; upper profile of head arched; suborbital ring minutely denticulate posteriorly; preopercle serrulate; lower limb of preopercle scaly; upper and lower teeth nearly equally broad, entire; caudal forked, the lobes rather pointed. Depth $2\frac{3}{4}$ in total. D. XII, 15; A. II, 13; scales 3–28–9. (*Günther.*) West Indies, north to West Florida.

(Müller & Troschel, Schomburgk's Barbad. 674; Günther, iv, 31; Goode & Bean, Proc. U. S. Nat. Mus. 1879, 338.)

aa. Preopercle entire.

b. Teeth entire. (*Hypsypops** Gill.)

957. P. rubicundus (Grd.) J. & G.—*Garibaldi.*

Uniform deep scarlet, unmarked; edges of fins dusky. Body short and deep, elevated, compressed, constricted behind the dorsal and anal, the caudal peduncle short and deep; head higher than long, the preorbital and suborbital regions being unusually deep; preopercle entire; cheeks, opercles, and top of head scaly; mouth small; lips thick; teeth compressed, narrow, blunt and entire, in a single row, dark at tips; gill-rakers short and flexible; preorbital anteriorly as wide as the eye; cheeks with 5 or 6 rows of rather small scales, opercles with several rows of larger ones; lips thick, the lower without frenum; soft fins rather high; pectorals reaching nearly to vent. Head $3\frac{1}{3}$; depth $1\frac{3}{4}$. D. XII, 16; A. II, 15; scales 5–30–13; Lat. l. on 21 scales. L. 12 inches. Coast of California, south of Point Concepcion; abundant about rocky islands.

(*Glyphisodon rubicundus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 148: *Parma rubicunda* Günther, iv, 58: *Hypsypops rubicundus* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 218.)

bb. Teeth emarginate. (*Glyphidodon*† Lacépède.)

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* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 165: type *Glyphisodon rubicundus* Grd. (*ὑψί*, high; *ὑπο*, below; *ὠψ*, eye; in allusion to the high suborbital region.)

† *Glyphisodon* Lacépède, Hist. Nat. Poiss. iv, 542, 1802: type *Glyphisodon moucharra* Lac. = *Chætodon saxatilis* Bloch. (*γλύφις*, notch; *ὁδὼν*, tooth.)

958. P. concolor (Gill) J. & G.

Dark olive, with 5 or 6 vague, dark cross-bands; pectoral with a tapering, black transverse line at base. Interorbital space convex, wider than orbit; breadth of infraorbital ring two-thirds the greatest breadth of the preorbital. Teeth rather broad, deeply notched. Depth $1\frac{4}{5}$. D. XII, 12; A. II, 9; scales 3–25–10. (*Günther.*) Both coasts of Central America, north to Florida Keys.

(*Euschistodus concolor* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 145: *Glyphidodon concolor* Günther, iv, 37: *Glyphidodon concolor* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 338.)

959. P. saxatilis (Linn.) J. & G.—*Cow-pilot; Mojarra.*

Greenish olive; head and fins dark; body with 5 or 6 black cross-bands, which are rather narrower than the interspaces; the first from the origin of the dorsal to the pectoral fin, the second downwards from fourth and fifth dorsal spines, the third from the ninth and tenth dorsal spines toward the vent, the fourth from end of spinous dorsal to middle of anal, the fifth below the end of the soft dorsal and continued on the posterior rays of dorsal and anal; a faint sixth bar at base of caudal. Soft dorsal and anal fins produced, the fourth and fifth rays of dorsal, and the fifth and sixth of anal, longest. Eye rather large, about as long as snout. Head rather short, $3\frac{1}{2}$ in length; depth $1\frac{3}{4}$. D. XIII, 14; A. II, 13; Lat. l. 27; pores on 21 scales. Tropical seas of America; occasional on our South Atlantic coast.

(*Chætodon saxatilis* Linn. Syst. Nat.: *Glyphidodon saxatilis* Günther, iv, 35: *Glyphidodon saxatilis* Goode, Bull. U. S. Nat. Mus. v, 38.)

326.—CHROMIS Cuvier.

(*Heliastes* Cuv. & Val.: *Furcaria* Poey: *Ayresia* Cooper.

(Cuvier, Mémoires du Mus. d'Hist. Nat. 1815: type *Sparus chromis* L. = *Chromis castanea* Risso, of the Mediterranean.)

Body rather deep. Preopercle entire. Mouth small; teeth small, conical, in two or more series, the outer larger. Scales rather large, 24–30 in a longitudinal series. Dorsal fin with 12–14 spines. Branchiostegals normally 5. Pyloric cœca 2. Gill-rakers long and slender. Tropical seas; species numerous. (χρομὶς the ancient name of some fish, probably a Sciænoid, from χρέμω, to neigh, from the noise made by the fish; akin to our names Grunter, Croaker, Drum, Hog-fish.)

960. C. punctipinnis Cooper.—*Blacksmith.*

Dark slaty blackish, with violet lustre above; some of the scales with a greenish spot or edging; fins bluish black; posterior part of

body with small round brown spots, which form more or less regular series; soft dorsal and caudal densely spotted. Body oblong, somewhat regularly elliptical. Head blunt, short, and deep, the profile abruptly descending to the snout. Lips thick, the lower without frenum. Teeth moderate, conical, in about two series, the inner very small. Cheeks, opercles, and top of head scaly. Spines stiff and low. Caudal forked; pectorals and ventrals long. Head 4; depth $2\frac{1}{3}$. D. XII, 11; A. II, 10; scales 4–29–10; 18 in course of lateral line; L. 9 inches. Pacific coast, north to Point Concepcion; not rare.

(*Ayresia punctipinnis* Cooper, Proc. Cal. Acad. Nat. Sci. 1863, 73.)

961. C. insolatus (Cuv. & Val.) J. & G.

Dark brownish, with metallic reflections; each scale on the head and anterior part of the body with a blue spot; young with two blue lines along the forehead convergent on the snout, and with a black spot immediately behind the dorsal fin. Caudal fin emarginate, with rounded lobes. Second anal spine more than half the length of the head; dorsal spines high; ventrals long; pectorals moderate. Depth 2; D. XIII, 12; A. II, 12; scales 2–28–9; cœca 2. West Indies, north to Southern Florida.

(*Heliases insolatus* Cuv. & Val. v, 494: *Heliastes insolatus* Günther, iv, 61.)

Family XCVII—EPHIPPIDÆ.

(*The Angel-fishes.*)

Body compressed, usually greatly elevated, the anterior profile steep. Scales moderate or small, ctenoid, densely covering the soft parts of the vertical fins; lateral line present, following the curve of the back. Mouth small, terminal, horizontal; premaxillaries protractile; maxillary short, without supplemental bone, partly slipping under the preorbital; jaws with bands of slender, pointed, movable, brush-like teeth; preopercle usually very finely serrated; gill-membranes broadly attached to the isthmus, the openings restricted to the sides; branchiostegals 6 or 7; pyloric cœca few; gill-rakers very short; pseudobranchiæ present. Dorsal fins 2, somewhat connected; the first of 8 to 11 spines, which are depressible in a groove; soft dorsal and anal fins anteriorly high, their bases thickened by the scales; anal spines 3 or 4, short; caudal fin truncate or nearly so; pectorals short; ventrals long, thoracic, I, 5; air-bladder large, commonly bifurcate in front, and with two slender horns behind. As here understood, a group of 4 genera and about 10

species, closely related to the *Chætodonts*, but said to show important differences in the skeleton. Fishes mostly of large size, in warm seas, sometimes entering rivers.

(*Squamipinnes* part; genera *Scatophagus*, *Ephippus*, and *Drepane*, Günther, ii, 57–65.)

a. Anal spines 3; dorsal spines 8 or 9, the third prolonged; profile very steep; scales small..... .....CHÆTODIPTERUS, 327.

327.—CHÆTODIPTERUS Lacépède.

(*Parephippus* Gill.)

(Lacépède, Hist. Nat. Poiss. iv, 503, 1802: type *Chætodon plumieri* Bloch=*Chætodon faber* Brouss.)

Body much elevated and compressed, its outline nearly orbicular, the anterior profile nearly vertical. Scales small, 55–70 in the course of the lateral line. Jaws about equal; no teeth on vomer or palatines; teeth on jaws slender, somewhat movable; preopercle finely serrulate. Branchiostegals 6. Dorsal fins 2, somewhat connected, the first of usually 9 spines, the third of which is elongate; anal spines 3, small, the second the longest; ventral with a large accessory scale. Pyloric cœca 4–6. American, distinguished from the Asiatic genus *Ephippus* by the very much smaller scales. (χαιτοδων, Chætodon; δις, two; πτερον, fin, the dorsal being divided.)

962. C. faber (Brouss.) J. & G.—*Angel-fish; Porgee.*

Grayish; a dusky band across the eye to the throat; a second similar band, broader, beginning in front of the dorsal and extending across the base of the pectoral to the belly; a third band, narrower, extending to the middle of the sides, from the base of the fourth and fifth dorsal spines; a fourth broader band from the last dorsal spine to the anal spines, the remaining bands alternately short and long; all of these bands growing obscure and disappearing with age; ventrals black. Vertical fins low in the young, falcate in the adult. Third dorsal spine nearly as long as from eye to edge of preopercle, its membrane blackish; chin with a row of pores; preorbital nearly as wide as eye; pectoral considerably shorter than ventral, the first soft ray of the latter filamentous. Head 3–3½; depth 1¼. D. VIII–I, 20; A. III, 18; Lat. l. 60; cœca 4–6. L. 2 feet. Warm seas; north to San Diego and New York; abundant on our South Atlantic coast; an excellent food-fish. Very large specimens, which we suppose to be old individuals, but which may possibly be a distinct species (*Ephippus gigas* Cuv.), have the occipital crest and anterior interhæmals developed in thick bony masses.

(*Chætodon faber* Broussonet, Ichth. Decas. 1, v, t. 4, 1782: *Chætodon faber* Gmel. Syst. Nat. i, 1263, 1789: *Zeus quadratus* Gmel. l. c. 1225; Günther, ii, 61: *Ephippus gigas* Cuvier,

Règne Anim.: *Ephippus gigas* Günther, ii, 61: *Ephippus gigas* Holbrook, Ich. S. Car., 107: *Ephippus faber* Holbrook, l. c. 110: *Ephippus zonatus* Girard, U. S. Pac. R. R. Surv. 110, from San Diego.)

Family XCVIII.—CHÆTODONTIDÆ.

(*The Chætodonts.*)

Body strongly compressed, elevated, suborbicular in outline, covered with moderate-sized or small scales, which are finely ciliated or nearly smooth; lateral line present, concurrent with the back, not extending on the caudal fin; mouth small, protractile, terminal; maxillary very short; teeth slender or setiform, often extremely long, in narrow bands in the jaws; no teeth on vomer or palatines; no canines, molars, or incisors; eyes lateral, of moderate size; branchiostegals 6 or 7; pseudobranchiæ very large; air-bladder present. Gill-membranes more or less attached to the isthmus; gill-rakers very small. Dorsal fin single, continuous, its rays sometimes filamentous, its soft part as well as the soft part of the anal densely covered with small scales; anal similar to the soft dorsal with 3 or 4 spines; ventrals thoracic, I, 5. Carnivorous fishes of the tropical seas, noted for their singular forms and bright colors. Genera 5 or more; species about 170, most of them belonging to *Chætodon* and *Pomacanthus*. (*Squamipinnes* part, Günther, ii, 1–57.)

a. Preoperculum without spine at its angle.....Chætodon, 328.
aa. Preoperculum with a strong spine at its angle.....Pomacanthus, 329.

328.—CHÆTODON Linnæus.

(*Sarothrodus* Gill: *Tetragonoptrus* Bleeker.)

(Linnæus, Systema Naturæ, x, 1758: type *Chætodon capistratus* L.)

Body short, deep, very strongly compressed, especially above and behind; head small, compressed, almost everywhere scaly; mouth very small, terminal, the jaws provided with long, slender, flexible, bristle-like teeth; preoperculum entire or nearly so, without spine. Dorsal fin single, continuous, not notched, the spinous part longer than the soft part, of about 13 spines; last rays of soft dorsal usually rapidly shortened; caudal peduncle short, the caudal fin fan-shaped; anal similar to soft dorsal, preceded by 3 or 4 strong spines. Body covered with rather large ctenoid scales, somewhat irregular in their arrangement; the lateral line curved, high, parallel with the back. Gill-openings rather narrow, the membranes narrowly joined to the isthmus; branchiostegals 6. A very large genus of singular-looking fishes, abounding in the

tropical seas; most of them have the body crossed by transverse black bars. (*χαίτη*, bristle; *ὀδών*, tooth.)

963. C. maculocinctus (Gill) J. & G.

Olivaceous, darker above; a dark-brown band from beginning of dorsal fin obliquely forwards through eye and across the cheeks; a second bar beginning in a blotch on soft dorsal, runs vertically across the body. Body suborbicular, closely compressed; profile steep, concave, the short snout projecting; mouth very small, maxillary not reaching the vertical from the anterior nostril; caudal peduncle very short; lateral line, beginning at upper angle of opercle, running obliquely upwards to opposite the base of soft dorsal and then decurved, ending opposite extremity of soft dorsal. Head $2\frac{3}{4}$ in length; depth $1\frac{1}{2}$. D. XII, 19; A. III, 17. Atlantic coast, rare.

(*Sarothrodus maculocinctus* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 99.)

329.—POMACANTHUS Lacépède.

(*Chætodon*, *Holacanthus*, and *Acanthochætodon* Bleeker.)

(Lacépède, Hist. Nat. Poiss. iv, 517, 1802: type *Chætodon arcuatus* L.)

This genus differs from *Chætodon* chiefly in the presence of a strong spine at the angle of the preopercle. Body much compressed and elevated; dorsal fin entirely scaly, with 8–15 spines; the anal with 3; scales moderate or small; branchiostegals 6; air-bladder with 2 posterior horns; pyloric cœca numerous. Species numerous in the tropical seas. Many of them are brilliantly colored. (*πῶμα*, operculum; *ἄκανθα*, spine.)

a. Dorsal spines 12 to 15. (*Holacanthus** Lac.)

964. P. ciliaris (Linn.) J. & G..—*Angel-fish; Isabelita.*

Brownish olive, each scale with a crescent-shaped mark of lighter; nape with a dark-brown spot ocellated with blue; chin, base of pectoral, borders and spines of opercle and preopercle bright cobalt blue; fins with blue and yellow. Body oblong, compressed and elevated; mouth small; scales ciliate; soft dorsal and anal with the anterior rays produced in long streamers. Head 4 in length; depth about 2. D. XIV, 20; A. III, 20; scales 8–50–30. West Indies, occasional on our South Atlantic coast.

(*Chætodon ciliaris* Linn. Syst. Nat.: *Holacanthus ciliaris* Lacépède, Hist. Nat. Poiss. iv, 527, 1802: *Holacanthus ciliaris* Günther, ii, 46: *Holacanthus ciliaris* Goode, Bull. U. S. Nat. Mus. v, 43.)

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*Lacépède, Hist. Nat. Poiss. iv, 525: type *Chætodon tricolor* Bloch. (*ὅλος*, complete; *ακανθα*, spine.)

aa. Dorsal spines 8 to 11. (*Pomacanthus*).

965. P. arcuatus (L.) Lac.

Dark brown, anteriorly plain; lower jaw pale; each scale with a dark spot and a whitish edge; young with yellowish vertical bands, sometimes spotted with black; base of pectorals sometimes yellow. Scales on body small, firm; large and small ones irregularly mixed. Head with shagreen, formed of rudimentary scales. Dorsal and anal extremely falcate, the anterior soft rays two-thirds the length of the body in the adult; dorsal spines very low; last anal spine long. Mouth small; gill-rakers short; gill-membranes very slightly joined to the isthmus mesially. D. IX, 30; A. III, 24; Lat. l. 80–100; cœca 15; vert. 10+14. West Indies, north to Garden Key, Florida.

(*Chætodon arcuatus* L. Syst. Nat.: *Pomacanthus paru, cingulatus, quinquecinctus,* and *arcuatus* Cuv. & Val. vii, 202–211: *Pomacanthus paru* Günther, iii, 55.)

Family XCIX.—ACANTHURIDÆ.*

(*The Surgeons.*)

Body oblong, compressed and usually elevated, covered with very small scales; lateral line continuous. Tail armed with one or more movable spines or bony plates. Eye lateral, high up; preorbital very narrow and deep. Nostrils double. Mouth small, low; each jaw with a single series of incisor-like teeth; vomer and palatines toothless; premaxillaries somewhat movable, but not protractile; maxillary short; gill-rakers obsolete; pseudobranchiæ large; gills 4, a slit behind the fourth; gill-membranes attached to the isthmus, the openings thus restricted to the sides. A single dorsal fin, with strong spines, the spinous part of the fin about as long as the soft part; anal fin similar, shorter; ventral fins present, thoracic, mostly I, 5 (never I, 4, I, as in *Teuthididæ*). Pelvic bone long, evident through the skin, as in *Balistidæ*, with which group the *Acanthuridæ* have numerous affinities. Pyloric cœca rather few. Air-bladder large. Herbivorous fishes of the tropical seas; genera 5 or more; species nearly 80, most of them belonging to *Acanthurus*.

(*Acronuridæ* Günther, iii, 356.)

a. Tail with a movable lancet-like spine on each side; incisors serrate.

Acanthurus, 330.

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* Called *Teuthididæ* in the key on page 78.

330.—ACANTHURUS Bloch & Schneider.

(*Acronurus* Gthr.; young.)

(Forskål; Bloch & Schneider, Ichthyol. 1801, 211: type *Chætodon chirurgus* Bloch.)

Body ovate-oblong, compressed, covered with minute ctenoid scales. Mouth rather small, with broad lobate or serrate incisors, which are sometimes movable. A movable spine in a groove on each side of tail. One dorsal fin, low and long, with 7–9 (sometimes fewer) spines; usually a procumbent spine before the dorsal; anal with 2 or 3 spines. Ventral rays I, 5. Caudal emarginate. Gill openings moderate, oblique, separated by a broad isthmus; operculum very short; preopercle oblique, with entire edge. Branchiostegals 5. Intestinal canal elongate. Vertebræ 9 + 13. (*ἄκανθα*, spine; *οὐρά*, tail.)

966 A. chirurgus Bl. & Schn.—*Surgeon-fish; Doctor-fish.*

Brownish; opercle with a black margin; sometimes a whitish band across tail at base of caudal; sides with dark transverse bands; vertical fins with oblique, parallel, dark streaks. Body oblong, compressed, and not greatly elevated; profile little convex, somewhat undulated. Vertical fins high; caudal moderately emarginate. Head 3½ in length; depth 2. D. IX, 25; A. III, 23. West Indies; occasional northward.

(Bloch & Schneider, 214; Günther, iii, 329, in part; Poey, Anales Soc. Hist. Nat. Espagn. 1880, 245.)

967. A. cœruleus Bloch & Schneider.—*Blue Surgeon; Barbero.*

Deep bluish brown, with undulating pale blue longitudinal lines, especially on the dorsal and anal fins, where they become straight and oblique. Upper profile of snout slightly concave. Caudal fin more or less deeply forked, the lobes bordered with pale in the adult; caudal spine glassy, amber-colored; opercles striate. Body very deep. Depth 1½ in length. D. IX, 28; A. III, 25. West Indies; occasional northward.

(Bloch & Schneider, 1801, 214; Poey, Anal. Soc. Hist. Nat. Espagn. 1880, 244: *Acanthurus nigricans* Goode, Bull. U. S. Nat. Mus. v, 42 (not of L.): *Acanthurus cæruleus* Günther, iii, 336.)

Family C.—TRACHYPTERIDÆ.

(*The King-of-the-Herrings.*)

Body elongate, strongly compressed, naked, the skin smooth or prickly. Lateral line present. Head short, the mouth rather small, terminal, with feeble teeth; premaxillaries protractile; opercles unarmed. Eye large, lateral. Branchiostegals 6. Gill-membranes sepa-

rate, free from the isthmus; gills 4, a slit behind the fourth. Pseudobranchiæ well developed, in a pouch formed by a fold of the mucous membrane. Dorsal fin single, extending from the head to the tail, its rays all technically spinous, being neither articulated nor branched, but all very soft, flexible, and fragile; anal fin wanting; pectorals short; ventrals thoracic, the rays elongate, often less than I, 5 in number; caudal fin either rudimentary or else divided into two parts, the upper and larger fan-shaped, directed obliquely upward from the slender tip of the tail. Bones very soft, the muscles little coherent. Pyloric cœca very numerous. Vertebræ in large number. Deep-sea fishes, often of large size, found in most warm seas. Their extreme fragility renders them rare in collections, and the species are little known. Genera 3; species about 15. They have no intimate relation with any other of our families.

(*Trachypteridæ* Günther, iii, 300–311.)

a. Ventral fins well developed; caudal present, not in the line of the axis of the body ..... TRACHYPTERUS, 331.

331.—TRACHYPTERUS Gouan.

King-of-the-Herrings.

(Gouan, Hist. Poiss. 1770, 104: type *Cepola trachyptera* Gmel.)

This genus is characterized by the well-developed ventral fins, composed of 4–6 branched rays each, and by the presence of a long fan-shaped caudal fin extending obliquely upward and backward from the end of the long and slender tail; lower lobe of the fin little developed; the anterior rays of the dorsal fin are usually elevated, and separated by a notch from the rest of the fin; the fin rays and the lateral line are often armed with prickles. Deep-sea fishes of large size. (τραχυς, rough; πτερον, fin.)

968. T. altivelis Kner.—*King-of-the-Salmon.*

Bright silvery, with three large round black spots below the dorsal fin; a fourth near the abdominal edge, a little below the first of the back. Anterior rays of the dorsal fin elevated; the longest rays of the posterior part of the dorsal nearly as deep as the body; dorsal rays rough, a small spine at the base of each of them; caudal fin with the erect lobe well developed, its outer rays longer and stronger than the intermediate rays; rays of the lower lobe short; skin prickly, the lateral line armed with small bony shields, each provided with a spine.

Head 7; depth 7. D. 7, 169 to 190; C. 6–5; P. 11; V. 7. (*Günther.*) Described from Valparaiso, Chili. A young specimen examined by us from Santa Cruz, Cal., agrees in essential respects, except that the skin is entirely smooth. The prickles are perhaps acquired with age, otherwise ours may be a different species. Two specimens of *Trachypterus* have also been taken in Puget Sound, but they have not been preserved.

(Kner. Wien. Sitzungsber, xxxiv, 437, 1859, taf. 1; Gunther, iii, 303.)

Family CI.—ICOSTEIDÆ.

(*The Ronquils.*)

Body oblong, compressed, naked or covered with small ctenoid or cycloid scales. Head moderate, not externally bony, the opercles unarmed. Mouth moderate, terminal; premaxillary protractile or not; maxillary moderate, without supplemental bone. Teeth small, in bands or in single series; vomer and palatines with or without teeth. No barbels. Lower pharyngeals separate. Branchiostegals 6 or 7. Gill-openings wide, the membranes free from the isthmus; gills 4, a slit behind the fourth; gill-rakers slender. Pseudobranchiæ large. Pyloric cœca few. Air-bladder present. Lateral line present. Dorsal fin very long, continuous, without distinct spines; anal long, without spines; caudal fin convex; ventral fins thoracic or subjugular, separate, but very close together, I, 4, or I, 5; pectorals rounded, sometimes fleshy at base. Vent normal, without papilla. Skeleton more or less soft and cartilaginous. This group, as at present constituted, is composed of three very diverse genera, each of a single species, inhabiting the deeper waters of the North Pacific. It is probably most nearly related to the *Malacanthidæ*, from which it is distinguished by the presence of pyloric cœca and by the non-labroid dentition.

(*Icosteidæ* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 306.)

a. Body naked, lateral line and fin rays beset with groups of spinules; skeleton not ossified. (*Icosteinæ.*)

b. Air-bladder present; teeth in jaws only, in single series, very slender; ventrals thoracic, 1, 4; caudal peduncle slender..... ICOSTEUS, 332.

aa. Body covered with small scales; no spinules; air-bladder wanting or rudimentary; ventrals 1, 5.

c. Skeleton imperfectly ossified; lateral line median. (*Icichthyinæ.*)

d. Teeth in a single series, minute, in jaws only; ventrals thoracic; caudal peduncle slender..... ICICHTHYS, 333.

cc. Skeleton ossified; lateral line near the back. (*Bathymasterinæ.*)

e. Teeth in bands, rather strong, on jaws, vomer, palatines, and pharyngeals; ventrals subjugular; caudal peduncle not slender..... BATHYMASTER, 334.

332.—ICOSTEUS Lockington.

(Lockington, Proc. U. S. Nat. Mus. ii, 63, 1880: type *Icosteus ænigmaticus* Lockington.)

Body oblong, much compressed throughout, the head thicker than any part of the body. Dorsal outline rising rapidly to the origin of the dorsal fin, thence more regularly curved; the region at the base of the dorsal and anal strongly compressed; caudal peduncle slender, widened at the base of the fin. Mouth large, horizontal; maxillary narrow, reaching to beyond middle of eye. Teeth in jaws in one row, slender, sharp, closely and regularly set, those in the lower jaw largest; no teeth on vomer, palatines, or pharyngeals. Gill-rakers flexible, few; gill-membranes separate, free from the isthmus. Branchiostegals 6. Pseudobranchiæ well developed. Lateral line conspicuous, continuous, decurved, groups of small spines present along its entire length. No scales anywhere on body or fins. Fins rough, with small spinules; a series along each ray, dividing as the ray branches; dorsal fin commencing above the axil of the pectoral, composed of 50–60 rays, which are all soft and flexible, some of the anterior unbranched; the fin low in front, increasing in height behind; none of the rays more than once forked; anal shorter than the dorsal, similar to it, of 35–40 rays; some of the anterior apparently undivided; caudal fin elongate, fan-shaped, the middle rays produced; accessory rays numerous, procurrent; pectorals with a fleshy base, fan-shaped, the middle rays longest; ventrals thoracic, inserted just behind the pectorals, narrow, consisting of 1 short subspinous ray and 4 long soft rays. Air-bladder large. Vertebræ numerous, the vertebral column extremely flexible and soft. Cranial bones tolerably firm; bones of the face and opercles very flexible. Deep-sea fishes, from the Pacific. (εἴκω, to yield, submit; ὀστεον, bone—the "entire body being characterized by a want of firmness, as it can be doubled up as readily as a piece of soft, thick rag.")

969. I. ænigmaticus Lockington.

Pellucid yellowish or brownish, with purplish spots and blotches of irregular form; the spots largest above, most numerous along the lateral line; fleshy bases of caudal and pectorals spotted; throat and gill-membranes with dark punctulations; fins dusky, obscurely blotched. Longest ray of dorsal nearly reaching base of middle caudal rays. Eye 6 in head, scarcely half the length of the snout or the width of the interorbital space; diameter of caudal peduncle about 5½ in greatest depth. Head 4; depth 3. D. 52–55; A. 37–40; V. I, 4; Lat. l. 110–120

(groups of spines). L. about 12 inches. Pacific coast of United States; three specimens known, from deep water.

(Lockington, Proc. U. S. Nat. Mus. ii, 63, 1880.)

333.—ICICHTHYS Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 305: type *Icichthys lockingtoni* J. & G.)

Body elongate, not elevated, not compressed at the bases of the vertical fins. Head moderate. Eyes lateral. Mouth terminal, little oblique, with small, sharp teeth in one series, in the jaws only. Premaxillaries not protractile. Gill-membranes separate, free from isthmus; gill-rakers long. Pseudobranchiæ present. Branchiostegals 7. Body covered with small cycloid scales. Lateral line continuous, unarmed. Bases of fins without spinules; dorsal and anal fins long and low, composed of soft rays only; pectoral fins moderate, their bases fleshy, as in *Icosteus;* ventral fins small, thoracic, I, 5. Pyloric cœca about 6, large. Bones all very flexible, cartilaginous. Deep-sea fishes. (ἰκτω, to yield or submit; ἰχθὺς, fish—in allusion to the flexible skeleton.)

970. I. lockingtoni Jor. & Gilb.

Plain brown, paler below, somewhat punctulate. Body oblong, somewhat compressed, the caudal peduncle rather slender. Head moderate, compressed, with vertical cheeks, rather broad and slightly convex above, the snout abruptly descending. Mouth moderate, little oblique, the slender maxillary scarcely widened at the tip, extending to beyond front of pupil; anterior edge of the premaxillary on the level of lower rim of eye; lips thin; premaxillary tapering backward, not forming the whole margin of the upper jaw; maxillary behind slipping entirely under the membranous edge of the preorbital; preorbital rather wide, with one or two series of rather large, thin, cycloid scales (other scales on head, if any, now lost on the typical example); lower jaw prominent, projecting in front, included at the sides. Teeth in jaws only, minute, sharp, closely and evenly set, larger and less numerous than in *Icosteus ænigmaticus.* Eyes large, lateral, longer than snout, 4 in head. Cheeks rather wide; preopercle with a prominent crest, behind which are some radiating mucous cavities; the bone with a broad, prolonged, flexible, membranaceous edge, covered with radiating striæ, each of which ends in a flexible point. Opercle and subopercle rather large, extremely thin, and each crossed by radiating striæ. Branchiostegals 7. Gill-rakers long, slender, sharp, close-set, and moderately stiff, their length nearly three-fourths the diameter of the eye. Scales very small, soft, and smooth, covering the body

evenly, but becoming smaller below. Lateral line nearly straight, apparently continuous. Dorsal fin long and low, beginning nearly midway between the vent and the base of the ventrals; all the rays soft and articulated, and all except the first branched; first rays very low, the fin gradually rising posteriorly, the highest rays 3 in head, somewhat scaly; anal fin similar, shorter, beginning slightly in front of the middle of the body and ending just in front of the last rays of the dorsal; caudal broad, fan-shaped, on a slender peduncle; the accessory rays numerous and procurrent; base of pectorals a little below the axis of the body, their outline rounded; the fin short and small, shorter than head; ventrals short and small, thoracic, placed a little behind pectorals, with 1 obsolete spine and 5 soft rays, one of which is slightly filamentous; the fin 3 in head; fin rays not beset with spinules. Vent normal, immediately in front of the anal, without papilla. Air-bladder wanting. Bones all soft and flexible. The skin not thick and tough, as in *Icosteus*, but thin and scaled. Head 5; depth 4. D. 40; A. 28; Lat. l. 120. L. 7½ inches. Deep water off San Francisco, Cal.; one specimen known.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. ii, 305, 1880.)

334.—BATHYMASTER Cope.

(Cope, Proc. Amer. Phil. Soc. 1873: type *Bathymaster signatus* Cope.)

Body rather elongate, moderately compressed, covered with small ctenoid scales. Head rather large, subconic. Eyes large. Mouth moderate, nearly horizontal, the lower jaw slightly projecting; lips full; premaxillary protractile, not extending to the angle of the mouth; maxillary without supplemental bone, not slipping under the narrow preorbital. Teeth moderate, in a cardiform band in each jaw, the outer somewhat enlarged; bands of teeth on vomer and palatines. No barbels. Branchiostegals 6. Gill-membranes scarcely connected, free from the isthmus; gill-rakers few, very short. Pseudobranchiæ large. Cheeks scaly; rest of head naked. Opercular bones unarmed. Mucous pores numerous on top and sides of head. Lateral line conspicuous, placed high, not reaching the caudal fin, its scales a little enlarged. Dorsal fin long, continuous, moderately high; two or three of the foremost rays inarticulate, but no distinct spines; anal fin long, similar to the dorsal; caudal convex; pectorals rather broad, their bases extending obliquely downward and backward, their rays all branched; ventrals slightly in front of pectorals, I, 5, close together,

the inner rays longest. Skeleton well ossified. Pyloric cœca few (2 or 3). No anal papilla. North Pacific. (*βαθυς*, deep; *μαστήρ*, a searcher.)

971. B. signatus Cope.—*Ronquil.*

Olivaceous, tinged with brown; about 8 round, faint bluish blotches along the sides, each surrounded by rings of yellow spots; a yellow ring around the eye and a yellow band along the cheek; fins translucent, the anal with a yellowish stripe and a bluish edging; dorsal reddish or yellow, with a dusky blotch in front; ventrals dusky; larger specimens nearly uniformly dark. Eye large, about as long as snout, 4 in head; its diameter much more than interocular space; maxillary extending to below front of pupil; cheeks closely scaly; rest of head entirely naked; a narrow, naked area in front of dorsal, bounded by rows of mucous pores; skull with large mucous cavities behind the eyes, which are translucent in life; scales of lateral line enlarged, twice as far apart as the others. Dorsal fin inserted at a distance behind the occiput, less than the diameter of the eye; pectorals $\frac{5}{6}$ the length of the head; fourth ray of ventrals longest; vent much nearer snout than root of caudal; caudal vertebræ about 33. Head $4\frac{1}{6}$; depth $6\frac{2}{3}$. D. 41; A. 33; V. I, 5; P. 18; Lat. l. 92 + 6 (tubes); scales in about 200 transverse series. L. 12 inches. Alaska to Puget Sound, about rocks, in water of moderate depth.

(Cope, Proc. Amer. Phil. Soc. Phila. 1873.)

Family CII (*a*)—LATILIDÆ.*

(*The Blanquillos.*)

Body more or less elongate, fusiform or compressed. Head subconical, the profile usually convex; suborbital without bony stay; cranial bones not cavernous; opercular bones armed or not. Mouth moderate, terminal, usually little oblique; teeth rather strong; premaxillary usually with a posterior canine; premaxillaries protractile; maxillary without supplemental bone, not slipping under the edge of the preorbital. Gills 4, a long slit behind the fourth. Pseudobranchiæ well developed. Gill-membranes separate, or more or less united, often adherent to the isthmus. Lower pharyngeals separate. Scales small, ctenoid. Lateral line present, complete. Dorsal fin long and low, usually continuous, the spinous portion always much less developed than the soft portion, but never obsolete; anal fin very long, its spines usually feeble and few;

*Called *Trachinidæ* in the key on page 78; see also family 102 (*b*), *Trichodontidæ*.

caudal fin forked; tail diphycercal; ventrals thoracic or subjugular, I, 5, usually close together; pectoral fins not very broad, the rays all branched. Vertebræ in increased number (35–50). Pyloric cœca few or none. Fishes of the temperate and tropical seas, many of them reaching a large size. Genera about 5; species about 10.

(*Trachinidæ*, group *Pinguipedina* Günther, ii, 251–254.)

a. Dorsal fin continuous; body scaly; upper jaws usually with posterior canines. (*Latilinæ*.)

b. Dorsal and anal with less than 20 soft rays each.

c. An adipose appendage at the nape; a fleshy prolongation on each side of the labial fold, extending backward, behind angle of the mouth.

LOPHOLATILUS, 335.

bb. Dorsal and anal fins each with more than 20 soft rays; no adipose appendage at the nape.....CAULOLATILUS, 336.

335.—LOPHOLATILUS Goode & Bean.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 205: type *Lopholatilus chamæleonticeps* G. & B.)

This genus differs from *Caulolatilus* and agrees with *Latilus* in the small number of dorsal and anal rays, and is distinguished from both by the presence of a large adipose appendage on the nape and by a fleshy prolongation upon each side of the labial fold, extending backward beyond the angle of the mouth. One species known. (λοφος, crest; *Latilus*.)

972. L. chamæleonticeps Goode & Bean.—*Tile-fish.*

Coloration brilliant; head and body with numerous greenish-yellow spots; upper portion of body with a violaceous tint; lower parts whitish, with some areas of yellow; caudal rays striped with greenish-yellow, some of the stripes connected by cross-blotches; anal and ventral fins whitish; pectorals violet-tinted, with some yellow on posterior surfaces; soft dorsal with an upper broad band of violaceous and a narrow basal portion of whitish; many rays each with a yellow stripe; anterior part of fin with some yellow spots. Maxillary reaching anterior margin of orbit; opercle and preopercle scaly, the latter finely denticulate; upper jaw with an outer series of stronger teeth, behind which is a band of villiform teeth; lower jaw with a few large canines and an inner series of small conical teeth; vomer and palatines toothless. Head 3 in length; depth $3\frac{1}{3}$. D. VII, 15; A. II, 13; scales 8–93–30. (*Goode & Bean.*) Abundant in deep waters off the coast of Massachusetts; a fine large fish, which may become important as food.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 205.)

336.—CAULOLATILUS Gill.

Blanquillos.

(*Dekaya** Cooper; preoccupied.)

(*Caulolatilus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 240; *nomen nudum*, defined in Proc. Acad. Nat. Sci. Phila. 1865, 66: type *Latilus chrysops* C. & V.)

Body elongate, subfusiform, not strongly compressed, heavy forward, tapering to a rather slender caudal peduncle. Profile of head strongly arched. Mouth moderate, little oblique, the jaws nearly equal; lips thick; maxillary narrow, not slipping under preorbital; teeth in villiform bands, preceded by a row of stronger acute teeth; hindmost teeth in each jaw canine-like, directed forward; posterior canines of upper jaw largest; no teeth on vomer or palatines; preopercle pectinate, the teeth nearly even; opercle with a blunt, flat spine. Eyes large, lateral. Gill-membranes slightly connected, forming a fold across the isthmus, with which they are narrowly joined. Branchiostegals 6. Gill-rakers short and stout. Nostrils double, round, close together. Scales small, firm, ctenoid. Lateral line continuous, concurrent with the back. Dorsal with 7–9 slender, pointed, graduated spines, and 22–27 soft rays; anal similar to soft dorsal, with 1 or 2 small spines, and more than 20 soft rays; caudal fin forked; ventral fins thoracic; no adipose appendage at the nape. Large fishes of the warm seas. (*καυλος*, stem; *Latilus*—*i. e.*, many-rayed *Latilus*.)

973. C. princeps (Jenyns) Gill.—*White-fish; Yellow-tail.*

Olivaceous, with bluish reflections; brownish above, greenish below; fins light greenish olive, tinged with bluish and orange, the colors always pale; dorsal and anal greenish, with a bluish band near the tip; axil dusky. Flesh of the occiput becoming thick with age, as in *Harpe*. Eye large, about half the convex interorbital space, $4\frac{1}{2}$ in head. Maxillaries reaching front of eye. Teeth rather strong. Preopercle finely, evenly, and acutely serrate behind, nearly entire below; preopercle, interopercle, and preorbital naked; cheeks and opercles scaly; top of head scaled on the median line to between the eyes. Dorsal spines flexible; ventrals slightly behind the pectorals, the outer rays longest; caudal moderately forked, the upper lobe the longer; caudal peduncle short and slender, abruptly contracted; pectorals falcate, longer than caudal, $\frac{5}{6}$ length of the head. Head $3\frac{2}{3}$; depth 4. D. IX–

Dekaya Cooper, Proc. Cal. Acad. Nat. Sci. 1864, 711: type *Dekaya anomala* Cooper; not *Dekayia* Milne-Edwards & Haime, 1851; a genus of corals.

24; A. II, 23; scales 16–125–40. L. 40 inches. Monterey, southward, abundant about the Santa Barbara Islands; a food-fish of considerable importance.

(?*Latilus princeps* Jenyns, Zoöl. Beagle, Fishes, 52 (from Galapagos Islands): *Dekaya anomala* Cooper, Proc. Cal. Acad. Nat. Sci. iii, 71, 1864: *Caulolatilus anomalus, princeps*, and *affinis* Gill, Proc. Acad. Nat. Sci. Phila. 1865, 68: *Caulolatilus anomalus* Streets, Bull. U. S. Nat. Mus. vii, 48, 1877: ?*Latilus princeps* Günther, ii, 253.)

974. C. chrysops (C. & V.) Gill.—*Blanquillo.*

Reddish, marked with yellow; a yellow band below the eye and a dark axillary blotch. Body rather robust. Interorbital width half length of snout. Snout longer than maxillary. Eye small, 6 in length, of head in adult. Fins rather short; caudal slightly emarginate; pectoral not reaching origin of anal, not one-fourth of total length. Head $3\frac{1}{2}$; depth $3\frac{1}{4}$ in length. D. VII–25; A. I, 23; Lat. l. 120; l. transv. 48. (*Goode & Bean.*) Pensacola, Fla., and southward.

(?*Latilus chrysops* Cuv. & Val. ix, 496, 1833 (from Brazil): ?*Latilus chrysops* Günther, ii, 253: ?*Caulolatilus cyanops* Poey, Rept. Fis. Nat. i, 312, 1867 (Cuba): *Caulolatilus microps* Goode & Bean, Proc. U. S. Nat. Mus. i, 43, 1878. The characters ascribed to the latter species, being details of form only, may be due to age, as greater differences occur between young and old of *C. princeps*.)

Family CII (*b*).—TRICHODONTIDÆ.

(*The Sand-fishes.*)

Body rather elongate, moderately compressed, naked. Head short, flat on top, the sides vertical. Eyes large, high up, but not superior. Mouth large, almost vertical; lower jaw projecting, its tip entering the profile; lips fringed; premaxillaries protractile; maxillary very broad, without supplemental bone, not slipping under the very narrow preorbital. Teeth moderate, slender and sharp, but not setiform, in bands on jaws and vomer; palatines toothless; inner teeth of jaws depressible. Gill-rakers very short; gill-membranes narrowly united, free from the isthmus. Branchiostegals 5. Gills 4, a slit behind the fourth. Preopercle with 5 prominent spines, the two upper directed strongly upward, the two lower downward, the middle one downward and backward; no barbels; opercle small, strongly striate, unarmed; preorbital with spines; no suborbital stay. Lateral line obsolete. Dorsal fins separate, the first the larger, of numerous slender, low spines; anal fin elongate, without distinct spines, the rays of the anterior third of the fin much shorter than the others; pectorals with a very broad, curved, procurrent base; a broad lunate area between pectoral and gill-opening, nearly covered by the opercle; soft rays of dorsal, anal, and pectoral fins all simple;

ventrals close together, thoracic, but behind the pectorals, I, 5, the middle rays longest; caudal lunate, with many accessory rays, on a slender peduncle. Two species known, from the North Pacific.

(*Trachinidæ*, genus *Trichodon* Günther, ii, 250.)

337.—TRICHODON Steller.

(Steller; Cuvier, Règne Anim. ii, 1829: type *Trachinus trichodon* Tilesius.)

Characters of the genus included above. (*θριξ*, hair; *ὀδὼν*, tooth.)

975. T. stelleri Cuv. & Val.—*Sand-fish.*

Olivaceous silvery, the back darker, with short bars and reticulations of blackish, the latter chiefly on the head and nuchal region; below this a longitudinal narrow white stripe, and then a narrow black stripe, interrupted anteriorly, extending from the eye to the base of the caudal; spinous dorsal with 2 lengthwise bands of black; chin and snout black. Eye large, placed high, 3 in head; maxillary extending to beyond its middle; the premaxillary near the level of its upper edge; cheek quadrate, as deep as long. Pectorals reaching past vent, the lower rays rapidly shortened, the width of its base $\frac{3}{4}$ its length, two-thirds the length of the head; anterior rays of anal less than half the height of the posterior. Head $3\frac{1}{2}$; depth the same. D. XV–18; A. 9, 19. L. 12 inches. Coast of Alaska, south to San Francisco, burying itself in the sand near the shore; not rare northward.

(*Trachinus trichodon* Tiles. Mém. Ac. Petersb. 1813, 466; Cuv. & Val. iii, 154; Günther, ii, 251: *Trichodon lineatus* Ayres, Proc. Acad. Nat. Sci. Phila. 1860, 60.)

Family CIII.—URANOSCOPIDÆ.

(*The Star Gazers.*)

Body more or less elongate, conic, terete or subcompressed, widest and usually deepest at the occiput. Scales small, smooth, adherent, arranged in very oblique series, rarely wanting. Lateral line feeble or obsolete. Head cuboid, partly mailed above. Eyes small, anterior, on the top of the head. Mouth vertical, the mandible strong and prominent; lips more or less conspicuously fringed; teeth moderate, on the jaws, and usually on vomer and palatines also; premaxillaries protractile; maxillary broad, without supplemental bone, not slipping under the preorbital. Gill-openings very wide, continued forwards; gill-membranes nearly separate, free from the isthmus. Branchiostegals 6.

Gills $3\frac{1}{2}$, a small slit behind the last. Pseudobranchiæ present. No anal papilla. Dorsal fins 1 or 2, the spinous part very short, the soft part elongate; anal long; caudal not forked; pectoral fins with broad oblique bases, the lower rays rapidly shortened, most of them branched, ventral fins jugular, close together, I, 5, the spine very short, the innermost rays the longest. Air-bladder generally absent. Pyloric cœca in moderate number. Carnivorous fishes of singular appearance, living on the sea-bottoms in most warm regions. Genera 7; species about 20.

(*Trachinidæ*, group *Uranoscopina* Günther, ii, 225–232.)

a. Dorsal fins 2; head without spines; no tentacle in the mouth..ASTROSCOPUS, 338.

338.—ASTROSCOPUS Brevoort.

(*Agnus* Günther: *Upselonphorus* Gill.)

(Brevoort; Gill, Proc. Acad. Nat. Sci. Phila. 1860, 20: type *Uranoscopus anoplos* Cuvier.)

Mouth large, the lower jaw without retractile tentacle within. Teeth narrow, in villiform bands, on jaws, vomer, and palatines; teeth of jaws depressible. Nostrils fringed; a curved furrow behind each eye, with its edges fringed. No spines about the head, the edges of the membrane bones covered by smooth skin; surface of the bones rugose; a broad plate on the occipital region, from the middle of which a Y-shaped projection extends forward, the tips of the fork being between the eyes; a trapezoidal space, covered by naked skin, bounded by the Y, the eye, the suborbitals and the occipital plate. Head scaleless; back and sides covered with close-set scales; belly mostly naked. Humeral spine obsolete; no spine before the ventrals. First dorsal small, of about 4 low, stout, pungent spines, connected by membrane to the second dorsal, which is rather high and long; pectorals and ventrals large. American, distinguished from the Old World *Uranoscopus* chiefly by the unarmed head. (*αστδον*, star; *σκοπέω*, to look.)

976. A. y-græcum (C. & V.) Gill.

Dark brown above, paler below; upper parts densely covered with small rounded white spots, each surrounded by a black ring; lower jaw and labial fringes similarly spotted; spinous dorsal black, white posteriorly; soft dorsal with 2 black and 2 white stripes; caudal black, with 2 white longitudinal stripes, its upper and lower edges narrowly white; anal white at base and tip, with a black median band; pectorals brown, with a black band below, the lower edge white, the

upper ray spotted; ventrals white. Width of pectorals less than half length of head, their length a little less than that of head; ventrals reaching three-fifths distance to vent. Scales small, evident, in very oblique series. Y-shaped bone on top of head conspicuous, on each side of it a broad naked area, said to be the seat of electric powers. A ridge of skin along middle line of belly from ventrals to vent. Head 3; depth 3. D. IV–I, 13; A. 12. L. 12 inches. West Indies, occasional on our South Atlantic coast.

(*Uranoscopus y-græcum* Cuv. & Val. iii, 308, 1829: *Uranoscopus y-græcum* Günther, ii, 229: *Upselonphorus y-græcum* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 113; Bean, Proc. U. S. Nat. Mus. 1879, 58.)

977. A. anoplus (Cuv. & Val.) Brevoort.

Brownish, everywhere covered with fine white spots; a dark lateral band on the caudal peduncle, near which the spots are larger; caudal with lengthwise stripes of black and pale. Form and armature essentially as in *A. y-græcum*. Pectoral a little longer than ventral, one-fourth shorter than the head. Scales on back evident, but small, the belly and lower part of the sides naked. Head $2\frac{1}{2}$; depth $3\frac{1}{3}$. D. IV–13; A. 12; Lat. l. 113. Atlantic coast of United States; rare.

(*Uranoscopus anoplos* Cuv. & Val. viii, 493 (young, said to be naked): *Agnus anoplus* Günther, ii, 229: *Astroscopus guttatus* Abbott, Proc. Acad. Nat. Sci. Phila. 1860, 365; Bean, Proc. U. S. Nat. Mus. 1879, 60.)

Family CIV.—GOBIIDÆ.

(*The Gobies.*)

Body oblong or elongate, naked or covered with ctenoid or cycloid scales. Dentition various, the teeth generally small; prepmaxillaries protractile; suborbital without bony stay. Skin of head continuous with covering of eyes. Opercles generally unarmed. Pseudobranchiæ present. Gills 4, a slit behind the fourth; gill-membranes united to the isthmus, the gill-openings thus restricted to the sides. No lateral line. Dorsal fins separate or connected, the spinous dorsal least developed, of 2–8 flexible spines, rarely wanting; anal usually without spine, similar to the soft dorsal; ventral fins close together, separate or fully united, each composed of a short spine and 5 soft rays, the inner rays longest; the ventral fins, when united, form a sucking-disk, a cross-fold of skin at their base forming a cup; caudal fin convex; anal papilla prominent. No pyloric cœca; usually no air-bladder. Carnivorous fishes, mostly of small size, living on the bottoms near the shores in warm regions. Some

inhabit fresh waters, and others live indiscriminately in either fresh or salt water. Genera 60–70; species nearly 400.

(*Gobiidæ* part; groups *Gobiina*, *Amblyopina*, and *Trypauchenina* Günther, iii, 1–138.)

* Ventrals separate; body scaly. (*Eleotridinæ.*)

a. Vomerine teeth present; isthmus narrow, the gill-openings continued forward below.....PHILYPNUS, 339.

aa. Vomerine teeth wanting; isthmus broad.

b. Scales small (60–100 in a lengthwise series); teeth fixed.....ELEOTRIS, 340.

bb. Scales large (30–35 in a lengthwise series); outer teeth movable. DORMITATOR, 341.

** Ventral fins united.

c. Dorsal fins separate. (*Gobiinæ.*)

d. Dorsal spines several.

e. Body scaly.

f. Scales ctenoid; dorsal spines 6; maxillary moderately developed, ending below the eye.

h. Teeth in the upper jaw emarginate, in one series; teeth of lower jaw horizontal.....EVORTHODUS, 342.

hh. Teeth all simple.

i. Teeth in the upper jaw in one series; those below in a very narrow band.....EUCTENOGOBIUS, 343.

ii. Teeth in several series in each jaw.

j. Teeth of the outer series fixed, somewhat enlarged; body not greatly elongate.....GOBIUS, 344.

jj. Teeth of the outer series setaceous, movable; body extremely long and slender.....GOBIONELLUS, 345.

ff. Scales very small, cycloid.

k. Maxillary inordinately developed, in the adult, reaching the gill-opening; dorsal spines 6.....GILLICHTHYS, 346.

kk. Maxillary moderately developed; dorsal spines 7 or 8. LEPIDOGOBIUS, 347.

ee. Body naked; teeth in bands; no canines.....GOBIOSOMA, 348.

dd. Dorsal spines 2; body naked; eyes obsolete.....TYPHLOGOBIUS, 349.

cc. Dorsal fin continuous; scales minute or wanting. (*Amblyopinæ.*)

l. Teeth in a single series.....TYNTLASTES, 350.

339.—PHILYPNUS Cuvier & Valenciennes.

(*Lembus* Günther.)

(Cuv. & Val. Hist. Nat. Poiss. xi, 255, 1837: type *Platycephalus dormitator* Bloch & Schn.)

Body elongate, terete anteriorly, compressed behind. Head elongate, depressed above. Mouth large; lower jaw longest. Teeth cardiform, on jaws and vomer; no teeth on palatines and tongue. Gill-openings continued forward below, so that the isthmus is very narrow. Scales moderate, ctenoid, covering most of the head. Dorsal fins well separated, the first of 7 spines; ventrals separate. Largest of the *Gobies*, some of the species reaching a length of nearly 2 feet Tropical rivers and bays. (ψίλυπνος, slumber-loving.)

978. P. dormitator (Bl. & Schn.) Cuv. & Val.

Brownish, marbled with darker; sides of head with 2 brown stripes; fins rose-colored, with series of brown spots; two oblong brown spots on base of pectorals. Snout sharp; maxillary reaching to opposite middle of orbit. Vomerine teeth in a crescent-shaped band. Eye small, half width of interorbital space. Caudal peduncle very long and rather slender. Head 3 in length; depth about 5½. D. VI–I, 9; A. I, 9; Lat. l. 60. L. 1–2 feet. Texas and southward, entering the rivers.

(*Platycephalus dormitator* Bl. & Schn. 60, 1801: *Eleotris dormitatrix* Günther, iii, 119; Cuv. & Val. xii, 255.)

340.—ELEOTRIS Gronow.

Tétards.

(*Gobiomorus* and *Gobiomoroides* Lacépède.)

(Gronow; Bloch & Schneider, Syst. Ichth. 1801, 65: type *Eleotris gyrinus* Cuv. & Val.)

Body long and low, compressed behind. Head long, low, flattened above, without spines or crests, almost everywhere scaly. Mouth large, oblique, the lower jaw projecting. Teeth in jaws villiform, fixed; no teeth on vomer or palatines. Preopercle and branchiostegals unarmed. Eyes small, high, anterior; isthmus broad. Dorsal fins well apart, the first of about 7 flexible spines; ventrals separate. Scales small, cycloid, 60–100 in a longitudinal series. Tropical seas, entering fresh waters. (ἠλεός, bewildered.)

979. E. gyrinus Cuv. & Val.—*Tétard; Sleeper.*

Brownish; vertical fins, with brown dots; two darker stripes behind the orbit. Body elongate, moderately compressed, of nearly equal depth throughout. Caudal peduncle long and deep. Head rather broad and flattened above, its scales minute. Mouth large, very oblique; maxillary reaching beyond the vertical from centre of orbit. Eye small, half width of interorbital space. Head 3½ in length; depth about 5. D. VI–I, 8; A. I, 8; Lat. l. about 60. Brackish waters, from Texas southward.

(?*Gobius pisonis* Gmelin, Syst. Nat. 1788, 1206; Cuv. & Val. xii, 220; Günther, iii, 122.)

341.—DORMITATOR Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 240: type *Eleotris gundlachi* Poey.)

Body oblong, the back broad and elevated; the head broad and deep. Mouth small, anterior; jaws subequal, each with a narrow band of slender teeth, those in the outer row movable; no teeth on vomer or palatines. Eyes moderate, lateral, wide apart. Head unarmed, almost

everywhere scaly. Scales large, ctenoid. Isthmus moderate; gill-clefts extended a little forward above; gill-rakers long. Pharyngeal teeth setaceous; an external series broad, flexible, lamelliform. Dorsal spines flexible, usually 7; ventrals separate. Brackish waters in the tropics. (Latin, *dormitator*, one who sleeps.)

980. D. limeatus Gill.

Brownish-yellow, thickly punctulated with darker, with a dark line running along the middle of each row of scales, and with a dark vertical blotch on the scapular region; head apparently with 2 dark longitudinal bands; dorsal and anal fins with 2 rows of dark spots near the base, a fainter one beyond; all the fins with minute dark dots. Head $3\frac{2}{3}$ in length; depth about $3\frac{1}{2}$. Eye equal to snout. D. VII–I, 10; A. I, 10; Lat. l. 32. (*Gill.*) Savannah, Ga.; probably identical with the next.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 271.)

981. D. maculatus (Bloch.) Gill.—*Sleeper.*

Dark brown, with lighter bluish spots; a faint dark stripe along sides; a large dark blue spot edged with black above base of pectorals, and a dark streak from eye to angle of mouth; two dark streaks on side of head; branchiostegal membrane blackish; dorsals barred with spots; anal dusky, barred with bluish, and with white margin; a dark bar on base of pectoral. Caudal a little shorter than head. Eye small, shorter than snout. Head $3\frac{1}{5}$ in length; depth about 3 (in the adult). D. VII–9; A. 10; Lat. l. 33. L. 12 inches. Rio Grande and southward to Guiana and Equador; very abundant in brackish waters. (Here described from specimens from Mazatlan.)

(*Sciæna maculata* Bloch, Ichth. taf. 299, f. 2: *Eleotris mugiloides* C. & V. xii, 263: *Eleotris maculata* Günther, iii, 112: *Eleotris sumnulentus* Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 28: *Eleotris somnolenta* Günther, iii, 557: *Dormitator omocyaneus* Poey, Syn. Pisc. Cubens, 396.)

342.—EVORTHODUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1859, 195: type *Evorthodus breviceps* Gill.)

Body elongate, covered with ctenoid scales of moderate size. Head thick, short. Isthmus moderate. Teeth in a single series, with the crown emarginate, those of the lower jaw horizontal; no canines. First dorsal of 6 spines; ventral fins united, not adherent to the belly. (ευ, well; ορθος, straight; οδους, tooth.)

982. E. catulus (Grd.) Gill.*

Olivaceous, with cross-blotches of darker. Body subfusiform. Head

* We are informed by Professor Gill that this species, or a species supposed to be the same, is an *Evorthodus*. The types are now lost.

not very blunt. Jaws even. Mouth somewhat oblique; maxillary extending to opposite the pupil; isthmus very wide. Dorsals well separated, the second somewhat longer than the first; anal short, inserted behind front of second dorsal; ventrals not reaching to vent; pectorals broad and rounded, reaching vent; dorsal spines not filiform. Head $3\frac{1}{2}$; depth about 4. D. VI–11; A. 11; Lat. l. 30. Saint Joseph's Island, Tex. (*Girard.*)

(*Gobius catulus* Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 26.)

343.—EUCTENOGOBIUS Gill.

(Gill, Ann. Lyc. Nat. Hist. N. Y. vii, 45, 1859: type *Euctenogobius badius* Gill.)

This genus differs from *Gobius* in the dentition, the teeth being pointed, in a single series in the upper jaw and in a very narrow band in the lower. (εὖ, well; κτεις, comb; *Gobius;* from the ctenoid scales.)

983. E. lyricus (Grd.) J. & G.

Brownish, obscurely barred with darker. Body oblong-elongate, tapering slightly from occiput to caudal peduncle. Head oblong, compressed. Snout very blunt; profile in front of eyes nearly vertical. Mouth moderate, nearly horizontal; maxillary reaching beyond middle of orbit. Teeth conical, rather strong, in two rows in front of lower jaw, in one on the side, and in one in the upper jaw. Fins all high; middle rays of spinous dorsal produced; caudal lanceolate; pectoral reaching beyond tips of ventrals, which reach the vent. Head $4\frac{1}{4}$ in length; depth about $4\frac{1}{4}$. D. VI–11; A. 11; Lat l. 32. Rio Grande.

(*Gobius lyricus* Girard, Proc. Acad. Nat. Sci. Phila. 1858, 169: *Gobius lyricus* Günther, iii, 550.)

344.—GOBIUS Linnæus.

Gobies.

(Artedi; Linnæus, Syst. Nat.: type *Gobius niger* L.)

Body oblong or elongate, compressed behind. Head oblong, more or less depressed. Eyes high, anterior, close together; opercles unarmed. Mouth moderate. Teeth on jaws only, conical, in several series, those in the outer row enlarged; no canines; isthmus broad. Scales moderate, ctenoid; cheeks usually naked; belly generally scaly. Dorsal usually with 6 spines; pectorals large; ventrals completely united, not adnate to the belly; caudal fin usually obtuse. Species very numerous. Our species are very little known, and some of them may not belong to this genus. (κωβιός; Latin, *Gobius* or *Gobio*, a name applied to the gudgeon (*Gobio fluviatilis*) and to other small fishes; allied to *Cobitis*, chub, etc.)

* Body entirely scaly.

a. Upper rays of pectorals partly free, finely branched, silk-like.

984. G. soporator Cuv. & Val.

Dark brownish-olive, marbled with darker, and with lighter dots along the series of scales; fins all blackish, the dorsal and caudal more or less distinctly barred; a dark blotch on temporal region. Body rather stout. Eye rather large, slightly less than snout. Head rather broader than high. Mouth rather large; jaws equal; maxillary to middle of eye. Cheeks naked; scales on nape much smaller than those on body; opercle not longer than eye; distance of first dorsal from eye equals that of snout from preopercle; upper rays of pectoral silk-like, the fin not quite as long as caudal, shorter than head; ventrals not reaching the vent, their basal membranes very broad. Head 3; depth $4\frac{2}{5}$. D. VI–I, 9; A. I, 8; Lat. l. 35; l. trans. 13. Both coasts of Mexico; very abundant southward, north to Florida.

(Cuv. & Val. xii, 56; Günther, iii, 26.)

985. G. carolinensis Gill.

Blackish-brown, indistinctly marked with lighter; a darker spot at base of caudal; a few light spots on operculum; fins purplish. Head $4\frac{1}{5}$ in total length (with caudal); depth about 5; caudal peduncle $\frac{1}{6}$ of total length, its height $\frac{1}{9}$ of the same; eye 4 in length of head; upper rays of pectorals silk-like; caudal $\frac{1}{5}$ total length, as long as pectoral. D. VI–I, 9; A. I, 8; Lat. l. 38; L. tr. 14; P. 18. (*Gill.*) Charleston, S. C.; the type now destroyed; probably identical with *G. soporator*.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 268.)

986. G. gulosus Grd.

Olivaceous, with transverse black spots on the back and longitudinal ones on the head. Snout subconical, the mouth very large, oblique, the lower jaw included; maxillary extending beyond the orbit. Eyes small, superior, their length 5 in head, twice the interocular space; isthmus moderate. Dorsals well separated, the first with some rays filiform; dorsal and anal barely reaching base of caudal; ventrals reaching vent; pectorals longer than ventrals; caudal rounded; scales moderate. Head nearly one-fourth the total length. D. VI–15; A. 15. Indianola, Tex. (*Girard.*)

(Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 26.)

987. G. würdemanni Grd.

Appearance of *Gobius lyricus*. Reddish-brown, obscurely barred with dusky. Head larger; caudal shorter; ventrals shorter; anal lower; scales smaller than in *G. lyricus;* teeth very slender, much smaller than in *G. lyricus*. Third dorsal spine filamentous. D. VI–11; A. 12.

Brăzos Santiago, Tex. (*Girard.*) Like the preceding, a dubious species, which may not belong to this genus.

(Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 25.)

aa. Pectoral with its upper rays normal, simple, or nearly so; scales large. (*Coryphopterus** Gill.)

988. G. glaucofrænum (Gill) J. & G.

Tawny, with a faint blue spot in the center of each scale, and with 6 spots, each formed by aggregation of dark dots, on the ridge of the back between the second dorsal spine and the axil of the soft dorsal fin; another row of similar but fainter spots runs from the scapular region, and a third row along the middle of the sides; head tawny, with dark spots and blue dots; a straight blue line across the cheeks; dorsal fins with faint blue spots. Body robust, compressed; head naked; mouth oblique, the lower jaw slightly projecting, the maxillaries extending to below pupil; teeth long, in many series, the outer curved; scales ctenoid, large. Pectoral fin with the upper rays little branched, not silk-like; cheeks scarcely tumid; caudal and pectoral longer than ventrals, about as long as head. Head $3\frac{1}{3}$; depth $4\frac{1}{3}$. D. VI–10; A. I, 9; P. 18; Lat. l. 25; l. transv. 7. L. $1\frac{1}{2}$ inches. Coast of Washington Territory. (*Gill.*) The original type is now lost, and the species has not been rediscovered.

(*Coryphopterus glaucofrænum* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 263.)

345.—GOBIONELLUS Girard.

Emerald-fishes.

(*Smaragdus* Poey.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1858, 168: type *Gobius lanceolatus* Bloch.)

Body extremely long and slender, the depth contained more than six times in the length to base of caudal. Scales small, ctenoid. Head not depressed, obtuse-convex, scaly above; cheeks and opercles naked; no barbels. Teeth small, in narrow bands, those in the outer row in the lower jaw setaceous, movable, in the upper jaw somewhat larger, fixed; no canines; lower jaw thin and flat. Dorsal with 6 spines; soft dorsal and anal many-rayed; caudal lanceolate. "Base of the tongue tuberculate, and shining with bright blue and green reflections, like a a precious stone" (hence the names *Smaragdus*, *Esmeralda*, etc.). Vertebræ elongate, 11 + 15. (A diminutive of *Gobius*.)

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*Gill, Proc. Acad. Nat. Sci. Phila. 1863, 262: type *Coryphopterus glaucofrænum* Gill. (κορυφή, summit; πτερον, fin.)

989. G. oceanicus (Pall.) J. & G.

Brownish, lighter below; a faint dusky streak along sides; a dark bar below eye; fins unicolor; pectorals dusky. Body much elongate, of equal depth throughout. Head short; profile very convex. Mouth large, oblique; jaws equal; maxillary reaching to below middle of orbit. Dorsal spines more or less elevated, filiform, usually higher than the soft rays; caudal from $\frac{1}{3}$–$\frac{1}{2}$ of length of body; pectoral slightly longer than head or than ventrals, none of its rays silk-like; basal membrane of ventrals well developed. Head $5\frac{1}{2}$–6 in length; depth about $7\frac{1}{2}$. D. VI–13; A. 14; Lat. l. 60–70, the scales much smaller and crowded, anteriorly. Coast of Texas to Guiana.

(*Gobius oceanicus* Pallas, Spicilegia, viii, 4, 1769, after *Gobius cauda longissima acuminata* Gronow: *Gobius lanceolatus* Bloch. Fische Deutschl. ii, 12, pl. 38, f. 1, 1784: *Gobius lanceolatus* C. & V. xii, 114: *Gobius bacalaus* C. & V. xii, 119: *Gobius lanceolatus* Günther, iii, 50: *Gobionellus hastatus* Girard, Proc. Acad. Nat. Sci. Phila, 1858, 169: *Gobionellus hastatus* Girard, U. S. Mex. Bound. Surv. 1859, 24.)

316.—GILLICHTHYS Cooper.

(Cooper, Proc. Cal. Acad. Nat. Sci. 1863, 111: type *Gillichthys mirabilis* Cooper.)

Body moderately elongate, compressed, covered with small, cycloid, imbedded scales; belly and head naked. Eyes small, almost superior. Gape wide, the maxillary in the adult inordinately developed, prolonged backward to the base of the pectorals; its posterior part a cartilaginous expansion, connected to an expansion of the skin of the lower jaw, thus forming a channel backward from the mouth, almost exactly as in the Blennioid genus *Neoclinus* and the Trachinoid genus *Opisthognathus*. Teeth small, even, in broad bands. Dorsal fins 2, the second high, the first of 6 very weak spines, none of which are exserted; caudal rounded; pectorals large; isthmus broad. Singular little fishes, in brackish waters, burrowing in the mud.

(Dedicated to Theodore Gill.)

990. G. mirabilis Cooper.—*Mud-fish.*

Dull olive, very finely marbled with darker; sides of head and maxillary finely punctate; fins olive; belly and ventrals yellowish. Body rather stout, somewhat compressed. Eyes small, high, anterior; maxillary in the adult reaching past base of pectorals, proportionately smaller in the young; in the very young the bone is scarcely larger than in other *Gobies*. Scales very small, smooth; belly and head naked, showing prominent veinings; dorsal spines very weak. Head $3\frac{1}{5}$; depth $4\frac{1}{2}$; maxillary, in adult, 3. D. VI–13; A. I, 10. L. 6 inches. Pacific

coast of United States, extremely abundant southward. It lives in shallow creeks and lagoons, where it fills the bottoms with holes and tunnels.

(Cooper, Proc. Cal. Acad. Nat. Sci. 1863, 111.)

347.—LEPIDOGOBIUS Gill.

(*Cyclogobius* Steindachner.)

(Gill, Ann. Lyc. Nat. Hist. N. Y. 1859, 14: type *Gobius gracilis* Grd.)

Scales small, cycloid; dorsal spines 7 or 8; otherwise essentially as in *Gobius*. Pacific Ocean. (*λεπιδος*, scaly; *Gobius*.)

a. Head scaly. (*Lepidogobius*.)

991. L. gracilis (Grd.) Gill.

Very pale olive, with roundish blotches of rusty red on back and sides; vertical fins mottled with reddish; distal half of all fins and under side of head blackish, especially in the males. Body elongate, long and low, little compressed, covered with thin, smooth, half-imbedded scales. Head scaly above and on cheeks and opercles; mouth oblique; jaws equal; maxillary extending to below middle of eye. Teeth in rather broad bands, the outer teeth enlarged, especially in upper jaw; outer teeth in lower jaw somewhat movable. Eyes large, placed high, the interocular space very narrow; opercle adnate to scapular arch from upper edge of pectoral upward. Fins rather high, the dorsal spines slender, flexible and exserted at tip; pectorals short, not reaching so far as tips of ventrals; ventrals inserted slightly behind axil of pectorals; basal sheath of ventrals large. Head 4; depth 6½. D. VII–18; A. 15. L. 5 inches. Pacific coast of United States; common northward, in rather deep water.

(*Gobius gracilis* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 134, not of Jenyns: *Gobius lepidus* Girard, U. S. Pac. R. R. Surv. Fish. 127: *Gobius lepidus* Günther, iii, 78.)

aa. Head naked. (*Eucyclogobius** Gill.)

992. L. newberryi (Grd.) Gill.

Olivaceous, mottled with darker; spinous dorsal and anal tipped with dusky; second dorsal and caudal checkered; pectorals transparent; head with some dusky markings. Body short, chubby, little com-

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*Gill, Proc. Acad. Nat. Sci. Phila. 1862, 330: type *Gobius newberryi* Grd. "The genus *Eucyclogobius* is very distinct from *Lepidogobius*, differing especially in the robust, subfusiform body, the size and position of the eyes, wider forehead, shape of jaws, and especially the position of the ventral fins." (Gill, Proc. Acad. Nat. Sci. Phila. 1863, 264.) (*ευ*, well; *κυκλος*, cycloid; *Gobius*.)

pressed. Head large, rounded above, the snout broad. Mouth large, oblique, the lower jaw somewhat projecting; maxillary extending to considerably beyond the posterior margin of the small eye. Teeth rather strong, in narrow bands, the outer row larger; outer teeth of lower jaw somewhat movable. Opercle adnate to scapular arch from upper edge of pectoral upwards. Scales very small, cycloid. Head naked. Fins moderate; dorsal spines very slender, not filamentous, lower than the soft rays; caudal truncate, about as long as pectorals, and considerably shorter than head; ventrals inserted under lower anterior edge of pectorals. Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. D. VIII–12; A. 11; Lat. l. about 60. L. $2\frac{1}{2}$ inches. Coast of California; rare.

(*Gobius newberrii* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 136: *Gobius newberrii* Günther, iii, 72: *Eucyclogobius newberrii* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 265.)

348.—GOBIOSOMA Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1858, 169: type *Gobius alepidotus* Bloch & Schneider.)

This genus differs from *Gobius* mainly in the entire absence of scales. The teeth are in several series, the outer row enlarged, and there are no canines. Dorsal spines usually 7. (*Gobius:* σῶμα, body.)

993. G. alepidotum (Bl. & Schn.) Girard.

Olive brown, with 7 or 8 paler transverse bars; fins dark brown; caudal with 2 or 3 curved bars. Body elongate, little compressed. Head somewhat flattened above; mouth rather small; maxillary extending nearly to opposite middle of orbit. Caudal fin pointed. Head $3\frac{1}{3}$; depth about $5\frac{1}{2}$. D. VII–14; A. 11. South Atlantic coast of United States.

(*Gobius alepidotus* Bl. & Schn. 547, 1801; Günther, iii, 85: *Gobius boscii* C. & V. xii, 93.)

994. G. molestum Girard.

Dusky brown; fins with blackish streaks. Head large, depressed; snout rounded; jaws even; maxillary scarcely reaching pupil. Caudal fin rounded, shorter than head; anal shorter than second dorsal; ventrals small, not reaching vent; pectorals broad, reaching beyond the ventrals; dorsals contiguous; isthmus very wide. Body short and chubby. Head $3\frac{1}{5}$; depth $4\frac{1}{2}$. D. VII–12; A. 12; P. 16. (*Girard.*) Coast of Texas; ascending streams, said to have been once taken at the Falls of the Ohio.

(Girard, Proc. Acad. Nat. Sci. Phila. 1858, 169; Günther, iii, 556.)

349.—TYPHLOGOBIUS Steindachner.

(*Othonops* Rosa Smith.)

(Steindachner, Ichth. Beiträge, viii, 142, 1879: type *T. californiensis* Steind.)

Body moderately elongate, compressed, covered with loose, smooth, naked skin. Head large, depressed, with tumid cheeks. Mouth large, the maxillary reaching to beyond the orbit; jaws equal, each with a narrow band of villiform teeth, the outer teeth slightly enlarged; lower jaw capable of little motion; snout rounded; no cirri. Eyes very small, imperfect, covered by skin. Fins low; first dorsal of 2 flexible spines; second dorsal moderate; anal very short; caudal rounded; ventral disk as in *Gobius*. Gill-openings rather narrow. One species known. (τυφλὸς, blind; *Gobius*.)

995. T. californiensis Steind.

Bright pellucid pink in life, the upper parts somewhat speckled; top of head with slight wrinkles of skin. Insertion of first dorsal midway between snout and base of caudal; insertion of anal opposite fifth ray of soft dorsal; pectorals as long as caudal, extending beyond ventrals to first dorsal; fin rays covered by loose skin. Eyes visible in life as small dark specks, disappearing in alcohol. Head $3\frac{3}{4}$; depth 5. D. II–11; A. 7; P. 16. L. 3 inches. San Diego, Cal.; burrowing in sand among rocks.

(Steindachner, Ichth. Beitr. viii, 142, 1879: *Othonops eos* Rosa Smith, Proc. U. S. Nat. Mus. 1881, 19.)

350.—TYNTLASTES Günther.

(Günther, Proc. Zoöl. Soc. London, 1862, 194: type *Amblyopus sagitta* Günther.)

Body elongate, compressed, covered with small, imbricate, cycloid scales. Head elongate, quadrangular. Mouth wide, oblique, the lower jaw projecting; teeth small, in single series, none on vomer or palatines. Eyes very small, or rudimentary. Dorsal fin single, continuous, about 6 of its anterior rays simple; caudal fin pointed, more or less joined to the dorsal and anal; ventral fins united. Air-bladder very small or absent. No pseudobranchiæ. Vertebræ 11 + 20. Pacific Ocean. (τυντλαστης, a mud-dabbler.)

996. T. sagitta Günther.

Grayish, sides and below silvery; an ovate gray spot before each dorsal ray; caudal gray. Body and head elongate, compressed, the length of the latter two-thirds the distance between the base of the ventral and the vent. Maxillary reaching to behind eye; teeth sub-

horizontal, very small. Scales becoming larger posteriorly. Caudal arrow-shaped, about one-fourth length of rest of body; pectoral as long as ventral, half as long as head. Head $5\frac{3}{5}$ (7 in total with caudal); depth $9\frac{3}{5}$ (12 with caudal). D. VI, 21; A. I, 20. L. $9\frac{1}{2}$ inches. "California." (*Günther.*)

(*Amblyopus* (*Tyntlastes*) *sagitta* Günther, Proc. Zoöl. Soc. Lond. 1862, 193.)

Family CV.—CHIRIDÆ.*

(*The Chiroids.*)

Cottoid fishes, with the body elongate, covered with small scales, which are either ctenoid or cycloid; head more or less conical, scaly, without armature above; preopercle sometimes armed; top of head without spinous ridges, but usually with dermal flaps; a bony stay across the cheeks from the suborbital. Mouth large or small, with teeth on jaws, and usually on vomer and palatines; teeth various. Gills 4, a considerable slit behind the fourth; gill-membranes free or variously attached. Branchiostegals 6 or 7. Pseudobranchiæ present. Dorsal fin elongate, continuous or divided, the anterior half or more composed of spines; anal fin elongate, with or without spines; ventrals I, 5; some or all of the soft rays branched. Pyloric cœca few or many. Lateral line present; sometimes several lateral lines. Carnivorous fishes of the North Pacific. Genera, 8 or 9 known; species about 15.

(*Triglidæ*, group *Heterolepidina* Günther, ii, 90–95: genera *Chirus*, *Ophiodon*, *Agrammus*, and *Zaniolepis*.)

a. Lateral lines 4 or more on each side; anal spines obsolete; mouth moderate; jaws with an outer series of stronger teeth, but no canines. (*Chirinæ.*)

b. Gill-membranes broadly united, free from the isthmus; scales mostly ctenoid. Hexagrammus, 351.

aa. Lateral line single on each side.

d. Gill-membranes free from the isthmus; preopercle armed.

e. Anal spines obsolete; scales cycloid; mouth large, with strong canines. (*Ophiodontinæ*) ..... Ophiodon, 352.

ee. Anal spines 3, strong; scales ctenoid; mouth small, without canines.

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* The *Chiridæ*, *Scorpænidæ*, *Cottidæ*, *Agonidæ*, *Triglidæ*, *Liparididæ*, and *Cyclopteridæ* from a closely-related series (*Cataphracti*), and are distinguished from all the other *Acanthopteri* by the presence of the suborbital stay. Different writers have widely separated some of the members of this group from the others, but the relations of each, especially of the *Scorpænidæ*, *Agonidæ*, and *Liparididæ*, with the *Cottidæ* are so close that it is difficult to draw satisfactory boundary lines.

f. Gill-membranes scarcely united; spinous dorsal greatly elevated in front; scales very rough. (*Zaniolepinæ*) ..... ZANIOLEPIS, 353.

ff. Gill-membranes broadly united; dorsal spines low, stiff; head pointed. (*Oxylebiinæ*) ..... OXYLEBIUS, 354.

dd. Gill-membranes united to the narrow isthmus; preopercle unarmed; anal spines weak or obsolete.

g. Dorsal fins connected. (*Agramminæ.*)

h. Anal* comparatively short, its rays about 12; palatine teeth present. MYRIOLEPIS, 355.

gg. Dorsal fins widely separated; body and head rather slender. (*Anoplopominæ*) ..... ANOPLOPOMA, 356.

351.—HEXAGRAMMUS† Steller.

Rock-trout.

(*Chirus* Steller: *Labrax* Pallas: *Acantholebius* Gill: *Chiropsis* Girard.)

(Steller; Tilesius, Act. Acad. Petropol. ii, 335, 1810: type *Hexagrammus asper* Steller.)

Body oblong, somewhat compressed. Head subconical, blunt in profile. Mouth rather small, horizontal; jaws with bands of moderate-sized, conical teeth, the outer row enlarged; teeth on vomer, and usually a small patch on the palatines; preopercle unarmed; a fringed

*Anal rays about 20 in *Agrammus schlegeli*, a Japanese species.

†The following species from the coast of Kamtschatka, related to *Hexagrammus*, have been made the types of distinct genera. These genera may be valid, if the characters assigned are correct, which is doubtful:

GRAMMATOPLEURUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 166: type *Labrax lagocephalus* Pallas.

Distinguished from *Hexagrammus* by the cycloid scales. (γραμμη, line; πλευρον, side.)

G. lagocephalus (Pallas) Gill.

Five lateral lines; mouth rather small; color golden-brown. D. XX–24; A. 22. Kurile Islands.

(*Labrax lagocephalus* Pallas, Mém. Acad. Petersb. ii, 384, 1810: *Chirus lagocephalus* Günther, ii, 92.)

OCTOGRAMMUS Bleeker.

(Bleeker, Versl. At. Amst. vi, 1370: type *Labrax octogrammus* Pallas = *Octogrammus pallasi* Bleeker.)

Distinguished from *Hexagrammus* by the union of the gill-membranes to the isthmus (?). (οκτο, eight; γραμμη, line.)

O. pallasi Bleeker.

Olivaceous; back and sides spotted; belly yellow; pectorals hyaline; ventrals black at tip: four lateral lines; mouth moderate; scales strongly ctenoid; body elongate; dorsal deeply notched. "Flabella branchio stega divisa." D. XIX; A. 24. Kamtschatka and Aleutian Islands.

(*Labrax octogrammus* Pallas, l. c. 393: *Chirus octogrammus* Günther, ii, 92; Bleeker, l. c.; = *Hexagrammus decagrammus*?)

supraorbital cirrus. Gill-membranes broadly connected, free from the isthmus; gill-rakers short, tubercle-like. Scales small, mostly ctenoid. Head more or less scaly, without spines. Lateral lines usually 5 on each side. Dorsal fin long, sometimes with a deep emargination between the spines and the soft rays; dorsal spines slender, 19–22 in number; anal fin elongate, with a single rudimentary spine; rays of pectorals and anal exserted and almost simple; pectoral rounded, with broad, procurrent base, the rays thick; ventrals well developed, placed at a considerable distance behind the root of the pectorals; caudal subtruncate. Branchiostegals 6. Pyloric cœca numerous (about 13). No air-bladder. Species of rather large size and bright coloration; abundant in the North Pacific. ($\xi\xi$, six; $\gamma\rho\alpha\mu\mu\eta$, line.)

a. Dorsal fin continuous, or but slightly emarginate. (*Pleurogrammus** Gill.)

997. H. monopterygius (Pallas) J. & G.

Dark olive above, yellowish below, the color of the back forming several broad cross-bars on the sides; fins dusky, nearly plain; the pectoral with blackish margin; ventrals blackish. Body rather stout, little compressed. Mouth moderate, the maxillary extending to below the front of the large eye. Teeth in the jaws in bands, the outer series somewhat enlarged and recurved; teeth on vomer, and a few asperities on the palatines. Supraocular cirri small. Cheeks partly naked; opercles well scaled; scales small, all rough. Five lateral lines, the fourth of these ceasing on the belly. Dorsal fin high and continuous; pectoral rather large; ventrals long, inserted behind the pectorals at a distance of twice the diameter of the eye. Head $4\frac{1}{4}$; depth 4. D. XXI–25; A. 24. Coast of Alaska; not rare.

(*Labrax monopterygius* Pallas, Mém. Ac. Sci. Petersb. ii, 391, 1810, and in Zoogr. Rosso-Asiat. iii, 281: *Chirus monopterygius* Günther, ii, 92.)

998. H. ordinatus (Cope) J. & G.

"Dorsal fins not very elevated, continuous, but with a slight depression at the point of union of the two; a dentate flap above each eye; lateral lines of pores 5, only three of which extend to the basis of the caudal fin, viz, the second, third, and fifth; the first extends to opposite the middle of the second dorsal; the fourth commences below and in front of the basis of the pectoral, and extends to a point a little behind that measured by the extremity of that fin; the inferior series of opposite sides converge and unite a little behind the basis of the ventrals

*Gill, Proc. Acad. Nat. Sci. Phila. 1861, 166: type *Labrax monopterygius* Pallas.

into a single median line, which extends to the branchiostegal fold. Radii Br. VI; D. XIX–25; C. 17, the interspaces scaled; the margin nearly truncate; A. 26; V. I, 5; P. 18. Head scaled above and on sides, except on interoperculum and muzzle. Scales ctenoid, 13–94–34. The scales are elongate, and nearly truncate distally; on the sides they are in oblique series, but near the dorsal fin from 3–5 rows exhibit scales superposed vertically. General color pale-orange, with ill-defined blackish shade on the sides, and 7 quadrate-blackish spots at the base of the dorsal fin; below, bright yellow; dorsal and caudal fin yellowish at base, margins with a broad blackish band; 3 black spots on the middle of the first, and 4 on the middle of the second dorsal fin; anal yellow, with 7 blackish blotches extending anteriorly across the rays; pectoral yellow, with brown spots on the rays and a black one at the base in front; eye with 5 blackish radii, diverging, two anteriorly, one upward and backward, one backward, and one downward and backward. Total length 14 inches; length of head entering it 4.33 times; depth of body 4 times in the same; eye 5 times in head, 1.66 times in muzzle, and 1.25 times in interorbital width." Coast of Alaska. (*Cope.*)

(*Chirus ordinatus* Cope, Proc. Amer. Phil. Soc. Phila. 1873.)

aa Dorsal fin with the spines separated from the soft rays by a deep notch. (*Hexagrammus.*)

b. Cheeks partly naked.

c. Scales all strongly ctenoid.

999. H. asper Steller.

Light or dark greenish, much mottled with blackish, rusty-red, and light blue, the dark color in the form of fine marblings, the reddish in the form of broad washes, and the bluish as roundish spots; two light-bluish bands downward and forward from eye, separated by a black-edged brown area; a whitish streak and various reticulate markings on cheeks and opercles; pectorals and dorsal mottled with brown spots; a dark humeral spot, distinct in the young; lower fins black in the male, pale in the female; flesh often tinged with green. Form rather slender. Maxillary reaching past front of eye, about to pupil. No teeth on palatines. Scales all strongly ctenoid, except on sides of head; region about suborbital stay and lower part of the opercles naked or nearly so; lower part of cheeks scaled in varying degree, generally more naked in large examples. A lateral line from occiput close to dorsal fin, ceasing near middle of spinous dorsal; one from occiput along back to base of caudal; one from angle of opercle to middle of base of caudal; one from just below the pectoral fin, undu-

lating along the sides of the abdomen, ceasing in front of tips of ventrals; one beginning on the median line of the breast, forking near the middle of the ventrals, the branches going straight to the lower part of the tail. Dorsal high, less deeply emarginate than in the following species; the spines high; caudal slightly emarginate; supraocular tentacles moderate, about as long as pupil; sexes not very dissimilar. Head $3\frac{2}{3}$; depth $4\frac{1}{3}$. D. XXII–I, 20; A. 23; Lat. l. 110. Alaska, south to San Francisco and Japan; abundant.

(Steller, MSS. Tilesius, Act. Acad. Petrop. ii, 340, 1810: *Labrax hexagrammus* Pallas, Zoogr. Rosso-Asiat. iii, 284, 1811: *Chirus hexagrammus* Günther, ii, 91: *Chiropsis nebulosus* Girard, U. S. Pac. R. R. Surv. Fish. 45, based on a specimen with some of the soft rays of the dorsal broken, resembling spines: *Chirus nebulosus* Günther, ii, 93: *Acantholebius nebulosus* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 166: *Chirus trigrammus* Cope, Proc. Amer. Phil. Soc. Phila. 1873: *Hexagrammus scaber* Bean, Proc. U. S. Nat. Mus. 1881, 154; based on very young specimens, showing a rudimentary additional lateral line along middle of side.)

cc. Scales mostly cycloid posteriorly; dorsal very deeply emarginate.

1000. H. superciliosus (Pallas) J. & G.

Blackish-green, varying to dark brown and cherry-red, the coloration and pattern extremely variable; sides usually with round pale spots, which are generally cherry-red, especially in the adult, but which are sometimes nearly white and often obsolete; belly mostly reddish; pectorals greenish or red, usually with 2 or 3 dusky crescent-shaped cross-bands at base, the outer portion often plum-color; fins mostly greenish or red, variegated; lower fins mostly dusky; flesh, and all membranes, livid green, especially in the adult; stomach and intestines of a livid green. Body rather robust. Orbital tentacle much larger than in other species, its length $\frac{2}{3}$ the diameter of the eye. A few teeth on front of palatines. Skin covering suborbital stay naked; cheeks otherwise scaly. Scales ctenoid on body anteriorly, becoming nearly smooth behind and on head. Lateral lines 5; one on the middle line from the nape, forking, and extending on each side nearly to end of second dorsal; the second to the upper edge of the caudal; one to the middle line of the tail; one from throat to about middle of anal; and one on the middle line of the belly, forking behind the ventrals, and extending on each side to the tail. Dorsal deeply emarginate. Caudal truncate or slightly rounded; pectorals large. Sexes similar. Head 4; depth $3\frac{1}{2}$. D. XX–23; A. 22; Lat. l. 107. L. 18 inches. Alaska to Monterey; not rare.

(*Labrax superciliosus* Pallas, Mem. Acad. Petersb. ii, 388, 1810, and in Zoogr. Rosso-Asiat. iii, 279: *Chirus pictus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 132: *Chiropsis*

pictus Grd. U. S. Pac. R. R. Surv. Fish. 43: *Chirus pictus* Günther, ii, 93: *Chirus pictus* Lockington, Proc. U. S. Nat. Mus. 1880, 54: *Chirus balias* Cope, Proc. Amer. Phil. Soc. 1873.)

bb. Cheeks wholly scaled; scales all ctenoid.

1001. H. decagrammus (Pallas) J. & G.—*Rock Trout; Boregat; Bodieron.*

Males clear brownish-olive of varying shade, often tinged with bluish or coppery and vaguely blotched; often with small blue spots; head and anterior part of body with rather large sky-blue spots, each surrounded by a rusty ring, these smaller and more numerous on the top of the head; lips with bluish spots; upper fins brown, mottled; ventrals and anal dusky-bluish; pectorals dark, both rays and membranes crossed by sharply-defined whitish reticulations, so that the fins appear to be *profusely spotted with white.* Females brownish, somewhat tinged with reddish, closely covered with round spots of a reddish-brown; these spots usually quite small and uniform over the whole back and sides; dorsal fin spotted on the scaly part, the fins otherwise plain reddish or bluish, the ventrals usually dusky; *pectorals light orange, without markings.* Other females ("*maculoseriatus*") have the ground color slaty-blue, with rows of round orange spots considerably larger than usual, and becoming vermiculations on the head; dorsal fin orange, clouded at base with blue; soft dorsal edged with bluish; pectorals plain orange; belly white. Body elevated at the shoulders, descending rather steeply at the nape. Maxillary not reaching middle of eye; a very few teeth on front of palatines; supraocular flap smaller than in other species, shorter than pupil. Cheeks and opercles entirely scaled; scales on the body all strongly ctenoid. Uppermost lateral line forking on the nape, the branches running to opposite the middle of the second dorsal; the second lateral line to upper edge of tail; the third to middle of tail; the fourth to a little beyond the middle of anal; the fifth to lower edge of tail; the fourth beginning near the lower edge of the pectorals and undulating opposite the ventrals, the lowermost on each side joining just in front of the vent, and proceeding on the median line to the middle of the breast. Dorsals high, scarcely connected; pectorals and ventrals large; caudal slightly emarginate. Head $4\frac{1}{5}$; depth 4. D. XXI–24; A. I, 23; Lat. l. 112. L. 18 inches. North Pacific; abundant from Point Concepcion to Alaska.

(*Labrax decagrammus* Pallas, Mém. Acad. Petersb. 1810, ii, 386, ♀, and in Zoogr. Rosso-Asiat. iii, 278: *Chirus decagrammus* Giinther, ii, 92: *Chirus guttatus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 132: *Chiropsis guttatus* Grd. U. S. Pac. R. R. Surv. Fish.

44: *Chiropsis constellatus* Girard, U. S. Pac. R. R. Surv. Fish. 42, ♂: *Chirus constellatus* Günther ii, 92: *Chirus guttatus, constellatus,* and *maculoseriatus* Lockington, Proc. U. S. Nat. Mus. 1880, iii, 53–55: *Grystes lineatus* (♂) Ayres, Proc. Acad. Nat. Sci. i, 9, 1854: ? *Labrax octogrammus* Pallas, Zoogr. Rosso-Asiat. 283, ♀.)

352.—OPHIODON Girard.

(*Oplopoma* Girard.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 133: type *Ophiodon elongatus* Girard.)

Body elongate, low, little compressed. Head long, rather pointed, its surface scaleless. Mouth terminal, very large. Jaws with very strong, sharp, unequal teeth, some of them canine-like; long series of cardiform teeth on vomer and palatines. Gill-openings very wide, the membranes not united, free from the isthmus. Preopercle with a few bluntish spines; a dermal flap above the eye. Scales very small, becoming smooth with age. Lateral line single, continuous. Dorsal fin long, deeply notched, the spines about 24 in number, slender and flexible, the middle ones highest; anal fin long, without distinct spines; ventrals, I, 5, inserted somewhat behind pectorals; pectoral fin broad. Pyloric cœca very numerous. Gill-rakers tubercle-like. Species of large size; among the largest of the cottiform fishes. (*οφις*, snake; *οδων*, tooth.)

1002. O. elongatus Grd.—*Cultus Cod; Blue Cod; Buffalo Cod; Ling.*

Dark brown above, much mottled; dorsal fin and whole upper part of body covered with small rusty brown spots of varying size and hue; lower parts of body of a livid bluish green, especially in the adult, the flesh and all membranes tinged with green; ground color often bluish or reddish tinged; young sometimes bright green; fins dusky, mottled, the dorsal and caudal with a very narrow, pale edging. Head large, the snout sharp, conic. Mouth very large, the lower jaw prominent; maxillary reaching beyond orbit; each jaw with a series of large pointed teeth, bent inward and immovable; front of upper jaw with 2–4 larger canines; outside of the series of large teeth each jaw has numerous small, sharp teeth; vomer and palatines with a single row of canines; supraorbital tentacle much shorter than pupil. Dorsal fin beginning above preopercle, the fin very deeply notched, the highest spines nearly one-third length of head; caudal emarginate. Head 3½; depth 5. D. XXV–21; A. 22. L. 40 inches. Pacific coast, Alaska to Santa Barbara; very abundant, reaching a weight of 30–40 pounds, being one of the most important food-fishes on the coast.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 133; Girard, U. S. Pac. R. R. Surv. Fish. 48; Günther, ii, 94: *Oplopoma pantherina* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 135, and in U. S. Pac. R. R. Surv. Fish. 46: *Ophiodon pantherinus* Günther, ii, 93.)

353.—ZANIOLEPIS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1857, 202: type *Zaniolepis latipinnis* Grd.)

Body elongate, little compressed, tapering from the nape to the long and slender tail. Head short, conical, the profile decurved. Mouth rather small, low, terminal, horizontal; cardiform teeth on the jaws, vomer, and palatines; no supraorbital cirri; preopercle with spines. Gill-membranes not united, free from the isthmus; gill-rakers tubercle-like. Scales small, imbricated, extremely roughly ctenoid. Lateral line single, continuous. Dorsal fin with about 21 spines; some of the anterior spines greatly elevated; a deep notch between the spines and soft rays; anal fin very long, with 3 spines, the second of which is longest; ventrals I, 5, long, inserted a little behind pectorals; pectorals moderate. Pyloric cœca few (5 or 6). North Pacific, in deep water. (ξαντον, a comb or card; λεπις, scale; hence more correctly spelled with an initial X.)

1003. Z. latipinnis Grd.

Olivaceous, the body and upper fins spotted with rusty brown; the vertical fins marked with blackish; a black streak before eye; suborbital bluish silvery. Body elongate, fusiform, scarcely compressed, the dorsal outline rising rather steeply. Mouth small, horizontal, low, the maxillary reaching nearly to the middle of the eye; the premaxillary entirely below the eye. Eye very large, longer than snout, $3\frac{1}{2}$ in head; preorbital wide, partly covering the scaly maxillary; interocular space rather narrow, somewhat concave; nasal spines present; preopercle with 3 sharp spines. Dorsal spines slender, stiff, the first and second longest, usually greatly produced, but stiffish to the tip, scarcely connected by membrane, reaching to nearly middle of second dorsal, and more than half the total length of the fish, but often much shorter; a deep notch between spinous and soft parts of dorsal; second dorsal high, its rays gradually shortened; anal long, its spines high; ventrals elongate, wide apart, reaching past front of anal; pectorals short and narrow; caudal short, slightly emarginate. Head and body everywhere covered with minute, imbricated, very rough, shagreen like scales. Head $4\frac{1}{3}$; depth $5\frac{1}{4}$. D. XXI–I, 11; A. III, 17. L. 12 inches. California, from San Francisco northward, abundant in deep water; a slender fish, of dry, firm substance.

(Girard, Proc. Acad. Nat. Sci. Phila. 1857, 202; Girard, U. S. Pac. R. R. Surv. Fish. 73; Günther, ii, 94.)

354.—OXYLEBIUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 277: type *Oxylebius pictus* Gill.)

Body oblong, somewhat compressed. Head conical, very slender, acuminate, the profile somewhat concave. Mouth small. Jaws each with a band of teeth, the outer series considerably enlarged; minute teeth on vomer; few or none on palatines. Top of head with dermal flaps. Preopercle with 2 blunt spines. Gill-membranes broadly connected, free from the isthmus; gill-rakers short, not very stout. Scales small, ctenoid. A single lateral line. Dorsal fin emarginate, with about 16 low, rather strong spines; soft dorsal moderate, its membrane closely scaled; anal with 3 stout spines, the second the longest; caudal truncate; pectorals rather long, their bases not procurrent; ventrals moderate, inserted well behind pectorals. Pyloric cœca few. Small fishes, of bright coloration. (οξυς, sharp; λεβιας—*Lebius*, an old synonym of *Hexagrammus*, from λεβιας, a kind of small fish suitable to be cooked in λεβης, a kettle.)

1004. O. pictus Gill.

Tawny grayish, with about 6 black bars, alternating with areas of pale orange, the latter obscured by dusky spots and blotches; the dark bars extending on the fins, the first across the nape, the second across the middle of the spinous dorsal, the third broader, across posterior part of spinous dorsal and front of anal; one across middle of soft dorsal, one on posterior part, and one at base of caudal; the bars are about as wide as the interspaces, and their edges are irregular, but sharply defined; pectorals and caudal orange, with cross-series of spots; ventrals largely black; under side of head orange, freckled, spotted with pale; 2 fringed cirri over each eye, scarlet; breast and belly marbled. Body rather deep, compressed. Head little compressed, slender, pointed; lips thick; lower jaw slightly included; maxillary small, barely reaching eye. Eyes large, about equal to snout, 4 in head; nasal spines present; interocular space narrow. Scales on sides of head very small; scales on body small, ctenoid, with strong horizontal striæ, those on breast minute. Dorsal fin continuous, its spines stiff, the middle ones highest, and all considerably lower than the soft rays; second anal spine longer than the third, about equal to the soft rays; pectorals barely reaching anal; ventrals to past vent. Head $3\frac{1}{3}$; depth $3\frac{1}{3}$. D. XVI–15; A. III, 13. L. 10 inches. Rocky shores, from Monterey northward; rare. A most beautiful and active little fish.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 277.)

355.—MYRIOLEPIS Lockington.

(Lockington, Proc. U. S. Nat. Mus. 1880, 248: type *Myriolepis zonifer* Lockington.)

Body oblong, somewhat compressed. Head heavy. Mouth moderate, the lower jaw slightly projecting; both jaws with bands of slender, sharp teeth, the front teeth slightly enlarged; similar teeth on vomer and palatines; preopercle entire; no dermal flaps. Gill-rakers short; gill-membranes very narrowly joined to the isthmus. Scales small, ctenoid, everywhere covering the head and body and the soft parts of most of the fins. Lateral line single. Dorsal fin deeply emarginate; the spines about 15 in number. Anal rather short, without distinct spines. (μυριος, many; λεπις, scale.)

1005. M. zonifer Lockington.

Black above, whitish below, with four broad black bars on the sides; the first over the pectorals; the second anterior to the vent, almost encircling the body; the third near the base of the anal, and the fourth encircling the caudal peduncle; a black bar at base of caudal and two across the fin; other fins blotched and banded with light and dark; ctenoid tips of the scales white. Head everywhere densely scaly, the only naked areas on the head being the lips and the folds of the gill-mmebranes. Scales on body largest posteriorly, small on head and chest. Vertical fins, except the spinous dorsal, covered nearly to the tips of the rays with small scales; external surfaces of paired fins similarly scaly; spinous dorsal with a few scales. Pectorals broad, lanceolate, not reaching the vent; fourth dorsal spine longest, the others diminishing regularly to the 12th. Eyes lateral, shorter than snout; interorbital space broad, slightly convex. Head 4 in total length; depth $3\frac{2}{3}$. D. XIV–I, 15; A. II, 11; Lat. l. 130. Monterey Bay, California; one specimen known.

(Lockington, Proc. U. S. Nat. Mus. 1880, 248.)

356.—ANOPLOPOMA Ayres.

(*Scombrocottus* Peters.)

(Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 27: type *Anoplopoma merlangus* Ayres = *Gadus fimbria* Pallas.)

Body elongate, little compressed, tapering into a very slender caudal peduncle. Head rather long, the snout somewhat tapering. Mouth terminal, moderate, the lower jaw included; maxillary very narrow, slipping almost entirely under the preorbital; teeth moderate, cardiform,

those in the lower jaw in a single series laterally, and in a narrow band in front; upper jaw, vomer, and palatines each with a band of similar teeth. Head entirely scaly. No supraorbital flap. Preopercle unarmed, its membranaceous edge crenulate. Gill-membranes joined to the isthmus. Body entirely covered with minute ctenoid scales. Lateral line single. Dorsals short, well separated, the first of slender, flexible spines; second dorsal shorter, similar to the anal, which is preceded by three weak spines; ventrals but little behind pectorals; caudal fin forked. Peritoneum black. Pyloric cœca about two, long and slender. Gill-rakers slender, few, not very short. North Pacific. (*ανοπλος*, unarmed; *πῶμα*, operculum.)

1006. A. fimbria (Pallas) Gill.—*Beshow; Coal-fish.*

Color slaty-black or grayish, somewhat reticulated; white below, the young rather pale; adult nearly black; fins dusky; caudal edged with pale; lining of the opercle black. Premaxillaries on the level of the lower part of the orbit; maxillary reaching to opposite front of pupil. Dorsal fins separated by a distance nearly equal to two-thirds length of the base of soft dorsal, the spines very weak; the fourth longest; pectorals reaching beyond tips of ventrals, not half way to vent. Head 4; depth $6\frac{1}{4}$. D. XX–I, 17; A. III, 15; Lat. l. 190. Usual length 18 inches, but sometimes much larger. Monterey to Alaska; rather common, especially northward. A very singular and interesting fish.

(*Gadus fimbria* Pallas, Zoogr. Rosso-Asiat. iii, 200, 1811: *Anoplopoma merlangus* Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 27: *Scombrocottus salmoneus* Peters, Berlin. Monatsber.)

Family CVI.—SCORPÆNIDÆ.

(*The Rock-fishes.*)

Cottoid fishes, with the body oblong, more or less compressed, the head generally large, and usually with one or more pairs of ridges above, which terminate in spines. Opercle usually with two spinous processes; preopercle with five. Mouth terminal, usually large, with villiform teeth on jaws and vomer, and usually on the palatines. Premaxillaries protractile; maxillary broad, without supplemental bone, not slipping under preorbital. Gill-openings wide; the gill-membranes separate and free from the isthmus; usually no slit behind the fourth gill. Scales ctenoid, or sometimes cycloid, usually well developed, sometimes nearly obsolete. Lateral line single. A bony stay extending backward from the suborbital toward the preopercle. Ventral fins thoracic, of the normal percoid form, I, 5, the rays branched; dor-

sal with 8 to 16 rather strong spines and about as many soft rays; anal rather short, with 3 spines and 5–10 soft rays; soft rays in all the fins branched, except some of the lower rays of the pectorals. Pyloric cœca in moderate or small number (less than 12). Pseudobranchiæ large. Air-bladder present. Genera about 20; species about 200, inhabiting all seas, but especially abundant in the temperate parts of the Pacific Ocean, where they form a large proportion of the fish fauna. They are non-migratory fishes living about rocks; most of them are of large size, and all are used as food. Many of them are viviparous, the young being produced in great numbers when about one-fourth of an inch in length.

(*Triglidæ*, group *Scorpænina* pt. Günther, ii.)

a. Dorsal spines 15; vertebræ 12 + 19; palatine teeth present.....SEBASTES, 357.
aa. Dorsal spines 13; vertebræ 12 + 15; palatine teeth present.....SEBASTODES, 358.
aaa. Dorsal spines 12; vertebræ 10 + 14; palatine teeth present; scales ctenoid, or provided with dermal flaps.....SCORPÆNA, 359.
aaaa. Dorsal spines 10 or 11; scales smooth, entire.....SETARCHES, 360.

357.—SEBASTES Cuvier.

Rose-fishes.

(Cuvier, Règne Anim. ed. 2, ii, 1829: type *Perca norvegica* Müller.)

Body oblong, compressed. Head large, scaly above and on sides; cranial ridges well developed. Mouth terminal, very broad, oblique, the broad maxillary extending to below the eye; lower jaw projecting, with a bony knob at the symphysis; palatine teeth present. Eye very large; preopercle with five divergent spines; opercle with two; suprascapular spines strong; gill-rakers long, slender. Scales small, ctenoid, irregularly arranged; no dermal flaps. Dorsal fin continuous, very long, the spinous part much longer than the soft part, of 15 strong spines; anal spines three, strong; caudal emarginate; pectorals long, narrow. Branchiostegals 7. Vertebræ 12 + 19. Coloration mostly red. Ovoviviparous. Species few, mostly of the Northern Seas. (σεβαστός, magnificent.)

1007. S. marinus (L.) Lütken.—*Rose-fish; Red-fish; Snapper; Hemdurgan.*

Orange red, nearly uniform, sometimes a dusky opercular blotch, and about 5 vague dusky bars on the back. Body ovate; back elevated, the ventral outline straightish; top of head evenly scaled; interorbital space with two low ridges, between which it is concave; nasal spines present; cranial ridges moderate, rather low and sharp; preocular, supraocular, postocular, tympanic, and occipital ridges present, the latter with the tips abruptly divergent; suprascapular spines very sharp

and prominent; opercular spines long and sharp; subopercular spine prominent; preopercular spines slender and sharp, the second longest; suborbital stay not reaching preopercle; preorbital narrow, with two spines. Eye exceedingly large, 3 in head, more than twice as wide as interorbital space. Mouth very large, oblique; maxillary very broad, reaching middle of eye, its length $2\frac{1}{3}$ in head; premaxillaries on level of middle of pupil; tip of lower jaw much projecting, with a conspicuous, pointed symphyseal knob; mandible and maxillary scaly; pseudobranchiæ very large; gill-rakers long, stiff and strong, about as in *Sebastodes pinniger*. Dorsal spines sharp, the longest about as long as eye; the fin deeply emarginate; soft rays not very high, higher than the spines; caudal narrow, moderately forked; anal spines moderate, graduated; the second a little shorter than eye; pectoral rather long, reaching vent, its base narrow; ventral reaching to vent. Scales small, irregular, not strongly ctenoid. Peritoneum brownish. Head 3; depth $2\frac{4}{5}$. D. XV–13; A. III, 7; Lat. l. 40 (tubes); scales about 85. Atlantic coasts of America and Northern Europe, south to Cape Cod.

(*Perca marina* L. Syst. Nat. x, 1758, in part: *Perca norwegica* Müller, Zoöl. Dan. 46: *Sebastes norwegicus* Günther, ii, 95.)

Subsp. **viviparus** (Kröyer) Lütk.

General color brownish red, somewhat mottled, with a blackish blotch on the opercle, and some other brownish spots on the body. Pectoral fins a little longer than in *S. marinus;* interocular space rather narrower. Head $3\frac{1}{4}$; depth $3\frac{1}{4}$. D. XV–14; A. III, 8. Arctic Seas, south to Cape Cod and the Baltic; smaller than the preceding and living near shore; thought to be a littoral variety.

(*Sebastes viviparus* Kröyer, Naturhist. Tidsskr. i, 275, 1844–'45; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 333: *Sebastes viviparus* Günther, ii, 96.)

358.—SEBASTODES* Gill.

Rock-fish; "Rock Cod."

(*Sebastichthys, Sebastoplus, Sebastomus* and *Sebastosomus* Gill.)

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 165: type *Sebastes paucispinis* Ayres.)

Body oblong or elongate, somewhat compressed; head large; mouth

* A very doubtful species, which may be the young of *Sebastes marinus*, with an abnormal number of spines, is accredited to our Atlantic coast, viz:

S.? fasciatus (Storer.)

"Body elongated, not convex in front of dorsal fin as in *Sebastes norvegicus;* four distinct dark brown transverse bands upon the sides, the broadest at the posterior portion of the body." D. XIII–14; A. III, 7. Provincetown, Mass. (*Storer.*)

(*Sebastes fasciatus* Storer, Proc. Bost. Soc. Nat. Hist. v, 31, 1854: *Sebastes? fasciatus* Gill, Proc. Acad. Nat. Phila. 1863, 335.)

moderate or large, with the jaws equal or the lower more or less projecting; teeth in villiform bands on jaws, vomer and palatines. Head more or less evenly scaled, without dermal flaps; cranial ridges more or less developed;* some or all of the following pairs present, usually ending in spines: preocular, supraocular, postocular, tympanic, coronal, occipital, and nuchal. Five preopercular spines. Two spines on the opercle and one to three on the suprascapula. Suborbital stay moderate, usually not reaching preopercle. Gill-rakers various. Scales moderate or rather small, ctenoid, in 45 to 100 transverse series. Dorsal fin continuous, emarginate, its formula XIII, 12 to 14. Anal fin III, 6 to 9. Pectorals well developed, the base broad or narrow, the lower rays undivided. Caudal truncate or slightly forked; soft parts of vertical fins more or less scaly. Pyloric cœca 6 to 11. Vertebræ 12 + 15. Species of rather large size, and varied, often brilliant colors, mostly red. Sexes colored alike. Most of them inhabit the Pacific Ocean, and they are exceedingly abundant in rocky places along the west coast of the United States. All are ovoviviparous, bringing forth great numbers of young, which are nearly half an inch in length when born. The species differ greatly in form and armature, but the genera based on these differences intergrade too closely to be worthy of retention. (σεβαστός, Sebastes; ειδος, likeness.)

ANALYSIS OF SPECIES OF SEBASTODES.

a. Scales very small; lat. l. 90–100; mouth very large, the lower jaw much projecting; skull thick, the cranial ridges weak. A. III, 9. (SEBASTODES.) Color light olivaceous red; young greenish.....*paucispinis.*

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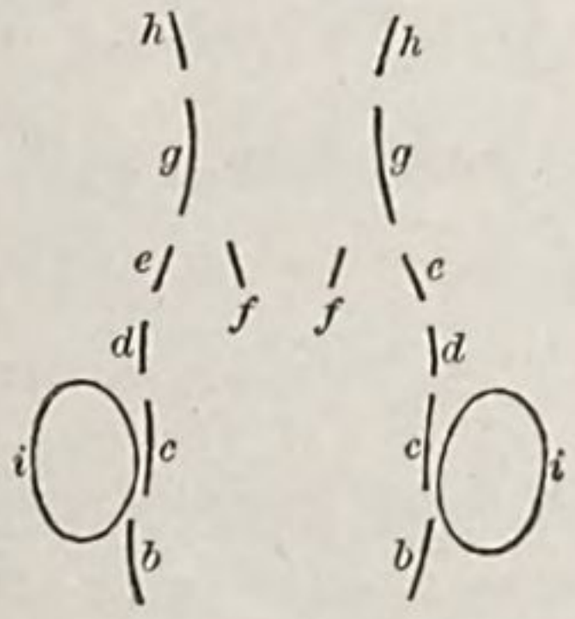
* *Diagram of cranial ridges of Sebastodes.*



a. Nasal spines.
b. Preocular spines.
c. Supraocular spines.
d. Postocular spines.
e. Tympanic spines.
f. Coronal spines.
g. Occipital spines.
h. Nuchal spines.
i. Eyes.

aa. Scales small; lat. l. 65 to 80; anal rays III, 7 to III, 9; skull thick, cranial ridges very low or obsolete; lower jaw much projecting; gill-rakers very long and slender; caudal emarginate; jaws scaly. (SEBASTOSOMUS Gill.)

b. Peritoneum white; cranial ridges all obsolete.

c. Color olivaceous, nearly plain; caudal yellowish or greenish; mouth large. *flavidus.*

cc. Color dusky, sides spotted with black; caudal dark; mouth smaller.. *melanops.*

bb. Peritoneum black.

d. Supraocular and occipital ridges obsolete, without spines; colors dusky, the fins blackish.

e. Preocular ridges obsolete, the frontal region between them not specially convex ..... *ciliatus.*

ee. Preocular ridges present, usually ending in spines, the frontal region between them bulging.. *mystinus.*

dd. Supraocular and occipital ridges mostly present, ending in spines; dorsal fin not deeply emarginate; soft dorsal low.

f. Second anal spine scarcely or not longer than third; postocular spine wanting; color creamy olivaceous..... *entomelas.*

ff. Second anal spine notably longer than third.

g. Body ovate; postocular spines present; color chiefly creamy or olivaceous ..... *ovalis.*

gg. Body rather elongate; postocular wanting; color chiefly red.. *proriger.*

aaa. Scales moderate; lat. l. 45 to 60; anal rays III, 5 to III, 7.

h. Cranial ridges very low, the skull thick and solid; lower jaw little projecting; interorbital space convex; gill-rakers slender, usually long.

i. Color olivaceous; postocular spine wanting; mandible with a few smooth scales ..... *atrovirens.*

ii. Color red; postocular spine present.

j. Scales on mandible smooth; color chiefly orange..... *pinniger.*

jj. Scales on mandible very rough; color chiefly brick-red.. *miniatus.*

hh. Cranial ridges more or less strong; skull comparatively thin; gill-rakers generally short.

k. Postocular and tympanic spines both present; interorbital space concave. (SEBASTOMUS Gill.)

l. Cranial ridges broken and armed with accessory spines (in the adult, nearly smooth in young); second anal spine scarcely longer than third; color red, nearly plain.. *ruber.*

ll. Cranial ridges smooth; second anal spine much longer than third; color rosy, with three or four round blotches of pink on sides of back.

m. Dorsal spines low, the highest less than half the length of head.

n. Body everywhere with small round pale spots. *constellatus.*

nn. Body without stellate spots.
o. Pale blotches on sides surrounded by purple shades; head with purplish above; mandible naked ..... *rosaceus.*
oo. Pale blotches on sides surrounded by green shades; no purple; cranial ridges very sharp; mandible partly scaly. *rhodochloris.*
mm. Dorsal spines very high, the highest half the length of head; body above with many small round green spots. *chlorostictus.*
kk. Postocular spine wanting.
p. Mandible scaly, its tip much projecting; peritoneum dusky; interorbital space concave; body comparatively elongate ..... *elongatus.*
pp. Mandible naked; peritoneum white; body deep.
q. Scales on head mostly cycloid; lower jaw projecting; second anal spine much stronger than third; color pinkish white, banded with deep crimson. ..... *rubrivinctus.*
qq. Scales on head ctenoid; lower jaw usually included; second anal spine little enlarged. (SEBASTICHTHYS Gill.)
r. Coronal spines present; cranial ridges moderate; color brownish, mottled. *auriculatus.*
rr. Coronal spines none.
s. Cranial ridges with entire edges.
t. Nuchal ridges none.
u. Gill-rakers extremely short, most of them as wide as high; general color dusky-greenish ..... *rastrelliger.*
uu. Gill-rakers higher than wide.
v. Highest dorsal spine notably more than half length of head.
w. Head and upper parts not speckled with orange; membrane of spinous dorsal not very deeply incised.
x. Color dark brown, varied with light brown ..... *caurinus.*
xx. Color reddish, varied with yellowish; dorsal spines higher. *vexillaris.*
ww. Head and upper parts everywhere speckled with orange; front of back yellowish; soft fins black; dorsal spines extremely high, their membranes deeply incised. *maliger.*

vv. Highest dorsal spine little if any more than half the length of head.
y. Pale blotches on sides not forming a continuous lateral band; occipital ridges moderate.
z. Pale markings flesh-color; dark markings olivaceous..*carnatus.*
zz. Pale markings yellow; dark markings blackish..*chrysomelas.*
yy. Pale blotches on sides, forming a continuous lateral band; body and fins profusely speckled with pale; dark markings black; pale markings yellow; occipital ridges very strong....*nebulosus.*
tt. Nuchal spines present, usually distinct from occipital; cranial ridges very short and high; olivaceous, banded with black; head red below .....*serriceps.*
ss. Cranial ridges with the surface broken, spinous; frontal ridges elevated; color bright red, with black bands.....*nigrocinctus.*

a. Species with very small scales (lat. l. 90–100); the cranial ridges little developed; the mouth very large, the lower jaw much projecting. (*Sebastodes.*)

1008. S. paucispinis (Ayres) Gill.—*Boccaccio; Merou; Jack.*

Pale dull orange red, dark brown above, the sides somewhat vaguely spotted; young olivaceous; fins nearly plain, lower reddish, upper dusky; tip of lower jaw dark. Body elongate, compressed, profile straight from the protruding tip of the lower jaw to the front of the dorsal. Head large, long, and narrow, pointed. Mouth much larger than in any other species, oblique, the broad maxillary reaching to beyond the eye; its length $1\frac{3}{4}$ in head; lower jaw very strong, with a projecting knob at tip, which protrudes farther than in any other species. Premaxillary on the level of lower edge of pupil. Cranial ridges little developed, the preocular and occipital traceable and sometimes ending in small spines. Interocular space broad, with two low ridges; top of head scaled to tip of snout; maxillary and preorbital scaly; preorbital with narrow neck and three small spines; suborbital stay moderate; preopercular spines sharp and diverging, the third largest, the lower often divided; opercular spines moderate. Gill-rakers slender, compressed, not very long. Eye large, 4–6 in head, slightly more than interorbital width. Scales very small and rough, irregular; accessory scales few. Dorsal spines low, rather slender, the fin deeply emar-

giuate; longest spine $\frac{2}{5}$ length of head, scarcely higher than the soft rays; caudal emarginate; anal low, its spines small, short, graduated, the second shorter than eye; pectorals narrow, rather long, not nearly reaching vent, the base $\frac{3}{4}$ diameter of eye; ventrals shorter, not reaching tips of pectorals. Peritoneum white. Head $2\frac{2}{3}$; depth $3\frac{3}{4}$; pectorals 5. D. XIII–13; A. III, 9; Lat. l. with 65–80 tubes; about 100 scales in a longitudinal series. L. 30 inches. Coast of California; abundant in rather deep water.

(*Sebastes paucispinis* Ayres, Proc. Cal. Acad. Nat. Sci. i, 6, 1854: *Sebastes paucispinis* Grd. U. S. Pac. R. R. Surv. Fish. 83; Gill, Proc. Acad. Nat. Sci. Phila. 1861, 165; Ayres, Proc. Cal. Acad. Nat. Sci. 1862, 215: *Sebastes paucispinis* Günther, ii, 98.)

aa. Species with scales small (lat. l. 60 to 70); cranial ridges little developed; skull thick; lower jaw strongly projecting; anal rays III, 7 to III, 9; jaws scaly; gill-rakers very long and slender. (*Sebastosomus** Gill.)

1009. S. flavidus Ayres.—*Yellow-tail Rock-fish.*

Olive green, rather pale, plain or finely spotted with yellowish; fins olive, caudal strongly tinged with yellow; young mottled. Body oblong, compressed, the back not much elevated. Head rather long, pointed. Mouth large, oblique, the maxillary extending to nearly opposite posterior margin of eye, 2 in head; premaxillaries in front on the level of lower margin of pupil. Lower jaw strongly projecting, its symphyseal knob very prominent, but less so than in *S. paucispinis.* Preorbital narrow, without spines. Top of head evenly scaled, the nasal spines only present and very small. Cranial ridges obsolete, without spines; only the occipital ridges visible under the scales. Interorbital space evenly convex. Preopercular spines rather strong, all of them directed strongly backwards; opercular spines moderate; suprascapular spines small, the upper obsolete. Scales medium; accessory scales variable. Dorsal spines low, slender, the longest 3 in head; the soft rays rather high, the fin very deeply emarginate, the membrane joining the thirteenth spine at about one-fourth its height; caudal fin notched; anal spines low, regularly graduated, the third spine less than half the height of the soft rays, the second as long as eye; pectoral fins shortish, rather broad, reaching tip of ventrals, but not quite to vent. Peritoneum white. Head 3; depth 3; pectoral 4. D. XIII–15; A. III, 9; Lat. l. about 60. L. 24 inches. Coast of California, abundant; an important food-fish.

(Ayres, Proc. Cal. Acad. Nat. Sci. 1862, 209, f. 64.)

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*Gill, Proc. Acad. Nat. Sci. Phila. 1864, 147: type *Sebastes melanops* Grd. (σεβαστος, Sebastes; σῶμα, body.)

1010. S. melanops (Grd.) Ayres.

Olive brown, dark above, the sides paler; upper part of sides thickly marked with small slaty-black blotches; head blackish above; a dark streak on maxillary and one from eye across cheeks; fins dusky, the dorsal paler at base, with many round dark olive-brown spots; a black opercular spot; lower rays of pectorals often tinged with orange. Body comparatively elongate, highest at shoulders. Head long, in form intermediate between *mystinus* and *flavidus;* snout rather sharp. Mouth large, oblique, the maxillary not quite reaching posterior margin of orbit; its length a little less than half head; lower jaw protruding, its tip on a line with the descending profile; premaxillaries on the level of the lower margin of pupil. Eye large. Cranial ridges almost obsolete, all scaled over and without spines in the adult; preocular spines obsolete, the space forward of the eye not projecting; preopercular spines short, but sharp. Gill-rakers longer than in *mystinus*, very slender. Dorsal rather low, deeply emarginate, the highest spines $2\frac{1}{3}$ in head, a little lower than the soft rays; caudal slightly emarginate. Anal spines small, the second shorter but stouter than third, longer than eye; pectorals short and rather broad, not reaching as far as tips of ventrals, which scarcely reach vent. Scales moderate; accessory scales numerous; mandible, maxillary, preorbital, and snout closely scaled. Peritoneum white. Head 3; depth $2\frac{2}{3}$. D. XIII–16; A. III, 8; Lat. l. 53; scales 60–70; pectoral $4\frac{1}{4}$. L. 20 inches. Monterey to Sitka; most abundant northward. At San Francisco much less common than *S. mystinus.*

(*Sebastes melanops* Girard, Proc. Acad. Nat. Sci. Phila. viii, 135, 1854, and in U. S. Pac. R. R. Surv. Fish. 81; Ayres, Proc. Cal. Acad. Sci. 1862, 213, f. 66: *Sebastes melanops* Günther, ii, 93: *Sebastosomus simulans* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 147.)

1011. S. ciliatus (Tiles.) J. & G.

Blackish green, the sides rather pale, much mixed with darker; dark shades from eye backward; a black streak on maxillary; fins all dusky, the upper fins somewhat mottled; adult said to have the body and fins tinged with red. Body rather deep and compressed. Mouth smaller than in *melanops*, the maxillary reaching to below posterior margin of pupil; lower jaw somewhat projecting, but without prominent knob at the symphysis; cranial ridges all obsolete, covered by scales; no preocular spine or any bulge of the skull in that region; preorbital narrow, without spine; preopercular spines short and broad; opercular and suprascapular spines small; lower jaw fully scaled, roughish. Head well

covered with ctenoid scales. Dorsal fin low, not deeply emarginate, the membrane joining the thirteenth spine near its middle; soft dorsal low, higher than the spines, the longest spine as long as maxillary, a little less than half head; caudal emarginate; anal low, its second spine stronger, but not longer than the third, $\frac{2}{3}$ the height of the soft rays, $2\frac{1}{2}$ in head; pectorals rather short, reaching beyond tips of ventrals to vent. Gill-rakers numerous, very long and slender, nearly as long as the eye. Peritoneum black. Head $3\frac{1}{3}$; depth $3\frac{1}{3}$; pectorals $3\frac{2}{3}$. D. XIII–15; A. III, 8; Lat. l. 66. Coast of Alaska; not noticed south of Kodiak.

(*Epinephelus ciliatus* Tiles. Mém. Ac. Sci. St. Petersb. iv, 474, 1810: *Perca variabilis* Pallas, Zoogr. Rosso-Asiat, iii, 241, 1811: *Sebastes variabilis* Cuv. & Val. iv, 347: *Sebastes variabilis* Günther, ii, 99.)

1012. S. mystinus Jor. & Gilb.—*Pêche Prêtre; Black Rock-fish.*

Slaty black, becoming paler below the lateral line; sides more or less mottled; tip of lower jaw black; top of head with 3 indistinct cross-bars, extending on the cheeks; a dark bar on anterior edge of opercle; fins all plain dusky. Body oval-oblong, compressed, both outlines evenly curved. Head rather blunt, compressed; profile oblique, almost straight, becoming convex with age. Mouth smaller than in any of the preceding species, oblique, the lower jaw protruding; premaxillaries on the level of lower rim of orbit; maxillaries dilated behind, reaching posterior margin of pupil, thickly scaled behind, their length $2\frac{1}{5}$ in head. Cranial ridges obsolete, except the preocular, which usually ends in a small spine; the region between and in front of the eyes bulging considerably; preopercle with rather strong spines, the two at the angle longest; opercular spines rather strong. Spinous dorsal very low, the longest spines $2\frac{1}{2}$ in head, lower than the soft rays, the fin rather deeply emarginate; second anal spine stronger than third, and a little shorter, $3\frac{1}{2}$ in head; pectoral fins long, about as long as head, their middle rays longest, reaching beyond the ventrals to about the tenth dorsal spine; caudal emarginate. Peritoneum black. Head $3\frac{1}{3}$; depth $2\frac{3}{4}$; pectorals $3\frac{1}{3}$. D. XIII–15; A. III, 9; Lat. l. 66 (50–55 tubes). L. 14 inches. Puget Sound to San Diego; the most abundant species of the family about San Francisco; found in rather shallow water.

(*Sebastichthys mystinus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 455; 1881, 56, 70.)

1013. S. entomelas Jor. & Gilb.

Dull olive-green; sides with obscure, round, rusty spots; belly, lips, and lower parts tinged with creamy; obscure light and dark shades

across cheeks; 2 or 3 very obscure dark vertical bars; fins all dusky, somewhat reddish tinged; lower half of pectoral reddish. Body oblong-elongate, the back little arched. Caudal peduncle slender. Profile less steep than in *ovalis*, the snout blunter. Mouth small, the short maxillary extending to below middle of eye, its length $2\frac{1}{3}$ in head; lower jaw protruding, its tip entering the profile; preorbital very narrow, without spine. Eye large, less than interorbital space, 4 in head. Cranial ridges very low, mostly covered by the scales; preocular, praocular, tympanic, and occipital spines usually present, the preocular larger than in any of the preceding species, the supraocular and tympanic sometimes obsolete; preopercular spines small, directed backwards; opercular spines small; jaws, preorbital, and snout with small scales. Gill-rakers numerous, long, and slender, their length about $\frac{2}{3}$ diameter of eye. Dorsal spines very low and slender, the longest about 3 in head, the fin moderately emarginate; soft dorsal long and low, not much higher than the spines; caudal lunate; anal low, its second spine stronger than third, but not so high, $3\frac{1}{4}$ in head; pectorals moderate, reaching beyond ventrals, not to vent. Peritoneum jet black. Head $3\frac{1}{4}$; depth $3\frac{1}{3}$; pectoral $3\frac{2}{3}$. D. XIII–15; A. III, 8; Lat. l. 65. L. 12 inches. Monterey Bay, in deep water; rare.

(*Sebastichthys entomelas* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 142.)

1014. S. ovalis Ayres.—*Viuva.*

Olivaceous, strongly tinged with creamy red, especially below; membrane of both dorsals covered with many small, round, black spots; similar spots usually on the body; upper fins greenish, lower yellowish, mostly dark-edged; caudal fin dark; young more green, with 2 or 3 large black blotches on upper part of sides, and without dark spots on fins. Body deep, almost oval, the back considerably elevated, the profile steep, the lower jaw considerably protruding. Mouth not large, the maxillary reaching to posterior edge of pupil, its length about $2\frac{1}{2}$ in head. Cranial ridges not much developed, except the preocular, which forms a large triangular protuberance, ending in a spine; preocular, supraocular, postocular, tympanic, and occipital spines present; preopercular spines long and slender, all projecting backward; opercular spines strong; preorbital narrow, with 2 bluntish spines. Gill-rakers very long and slender, the longest two-thirds the diameter of the eye. Eye large, slightly longer than snout. Dorsal fin very low, the notch between the spinous and soft parts very shallow, the height of the two parts about equal ($2\frac{1}{2}$ in head), the membrane joining the last spine at

about $\frac{3}{4}$ its height; second anal spine longer and stronger than third, almost as high as the soft rays, $2\frac{1}{3}$ in head; pectorals long, reaching beyond tips of ventrals; caudal emarginate; maxillary and mandible scaly. Peritoneum black. Head 3; depth $2\frac{3}{4}$. D. XIII–14; A. III, 8; pectoral $3\frac{1}{5}$; height of dorsal 8; Lat. l. about 70. L. 14 inches. Coast of California, in deep water; rare.

(Ayres, Proc. Cal. Acad. Sci. 1862, 212, f. 65: *Sebastichthys ovalis* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 143.)

1015. S. proriger Jor. & Gilb.

Bright light red, mottled above with dusky olive-green, the ground color forming distinct blotches under the third dorsal spine and under the first and last rays of the soft dorsal; lateral line running in the middle of a very distinct continuous red stripe, precisely as in *S. elongatus*; head above with purplish cross-shades; opercle with a dusky blotch; two olive shades radiating from the eye; lips and tip of lower jaw blackish; iris red; caudal fin bright red, speckled with dark olive; spinous dorsal bright red, the posterior part of each membrane blackish; soft dorsal olive and red; lower fins bright light red, with shades of olive yellow. Body elongate, somewhat compressed, a little less slender than in *S. elongatus*, which this species much resembles in color and form. Head rather small. Mouth small, much as in *S. ovalis*, the short, broad maxillary extending to beyond the middle of the eye, the premaxillary on the level of lower margin of pupil; maxillary $2\frac{1}{4}$ in head; lower jaw strongly projecting, with a conspicuous symphyseal knob. Eye very large, longer than snout; preorbital narrow. Cranial ridges very low and weak; preocular, supraocular, tympanic, and occipital present; most of the ridges partly covered by scales; tympanic spine minute; occipital ridge not conspicuous, the spine depressed. Preopercular spines sharp, the second longest, the points of all directed backward; opercular spines moderate. Interorbital space broad, nearly as broad as the eye, somewhat regularly convex, the middle being elevated. Gill-rakers very long, slender, and numerous, the longest longer than the supraocular ridge, and about half the diameter of the eye. Scales rather small. Dorsal fin very low, as in *S. ovalis*, not deeply emarginate, the highest spine little more than one-third length of head; soft dorsal low, half as high as long, the highest ray about equal to the longest spine; caudal fin moderately forked; anal fin low, its length nearly equal to the height of its longest ray; second spine much longer and stronger than the third, scarcely shorter than the longest ray, $2\frac{1}{3}$

in head; pectorals rather long and narrow, the tips reaching beyond the tips of the ventrals to the vent. Peritoneum black. Head 3; depth $3\frac{1}{3}$. D. XIII–13; A. III, 7; pectoral $3\frac{1}{4}$ in length; Lat. l. 75. L. 10 inches. Coast of California, in deep water; not rare.

(*Sebastichthys proriger* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 327.)

aaa. Species with the scales moderate, the cranial ridges low, the skull thick, the interorbital space broad and convex, the lower jaw scaly, its tip not strongly projecting; gill-rakers slender; pectorals narrow; peritoneum white.

1016. S. atrovirens Jor. & Gilb.—*Garrupa.*

Olive-green, marbled with darker; sometimes brownish; belly pale yellowish green; fins olivaceous, no red anywhere. Body oblong, not tapering rapidly backward. Head moderate, rather pointed. Mouth moderate, the lower jaw somewhat projecting, the maxillary extending to beyond posterior border of the pupil; its length 2 in head; premaxillary below pupil. Eye large, $3\frac{1}{2}$ in head Cranial ridges low, not ending in prominent spines; the following pairs are present: preocular, supraocular, and occipital, and sometimes a minute tympanic; nasal spines prominent; preorbital very narrow, with two stout spines; preopercular spines short, rather sharp, the second longer and slenderer than the others; opercular and suprascapular spines sharp; interorbital space broad and slightly convex, widened backward, a little depressed on each side next the supraocular spine, its width less than that of the eye and more than the length of the occipital spine. Gill-rakers slender, not very long, the longest $\frac{1}{3}$ the diameter of the eye. Preorbital scaly; maxillary partly scaly; mandible with some smooth scales; scales large, regularly arranged. Dorsal fin rather deeply emarginate, the spines moderate, the fifth half length of head and lower than the soft rays; caudal truncate; anal fin short and high, its spines slender, the second shorter than third, and not much stronger, about $2\frac{1}{2}$ in head; longest soft rays $1\frac{1}{2}$ in head; pectorals long and narrow, reaching past vent nearly to beginning of anal, their length seven-eighths that of head, their base narrow. Ventrals long, reaching just past the vent. Head 3; depth $2\frac{4}{5}$. D. XIII–14; A. III, 6; Lat. l. 52. L. 15 inches. Coast of California; generally abundant, especially southward.

(*Sebastichthys atrovirens* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 289.)

1017. S. pinniger (Gill) J. & G.—*Fliaum; Orange Rock-fish.*

Ground color light olive-gray; profusely blotched with bright clear orange-red or with light orange-yellow, the red shades predominating

above, the pale below; belly nearly white; top of head with cross-blotches and marblings of orange, alternating with pale; sides of the head flesh-colored, with three bright orange bands radiating from the eye; maxillary with orange touches; lips pale, tinged with blackish; inside of mouth pale; dorsal fin with the membrane bright orange, a large black blotch occupying the membranes between the seventh and tenth dorsal spines; this spot is usually distinct, but in old examples it is sometimes obsolete; pectorals light red, mottled with yellowish; other fins all bright orange, without dusky tips, slightly mottled with paler at base; lateral line running in a distinct continuous light-gray streak, which is not crossed by the red markings; old specimens sometimes with large inky blotches on different parts of the body. Body rather robust, elevated, and compressed. Mouth large, oblique, the maxillary reaching to below the posterior margin of the large eye, its length half the head; mandible somewhat projecting, with a knob at the tip; the middle teeth on a raised base which fits into the emargination of the upper jaw; interorbital space very broad, concave on either side of the convex center, as wide as the eye, which is 4 in head; cranial ridges low, but stronger than in preceding species; preocular, supraocular, postocular, tympanic, and occipital present; the space between the two occipitals concave; the ridges small but sharp; both jaws, preorbital, maxillary, mandible, and snout scaly, the scales on the lower jaw smooth; preorbital rather narrow, with two spines; preopercular spines long and sharp. Dorsal fin deeply emarginate, the spines rather high, nearly as high as the soft rays, the longest $2\frac{1}{2}$ in head; caudal fin lunate; pectoral fin long, reaching to the tips of the long ventrals, past the vent; base of pectoral narrow, about as broad as eye; second anal spine strong, nearly as long as third, 3 in head. Gill-rakers very long and slender, nearly $\frac{2}{3}$ diameter of eye; accessory scales numerous, especially on head. Peritoneum pale. Head $2\frac{2}{3}$; depth $2\frac{3}{5}$; pectoral $3\frac{1}{2}$. D. XIII–14; A. III, 7; Lat. l. 48. L. 25 inches. Pacific coast, from Monterey northward; one of the most important species.

(*Sebastodes rosaceus* Ayres, Proc. Cal. Acad. Sci. ii, 216, 1862, f. 62; not *Sebastes rosaceus* Grd.: *Sebastosomus pinniger* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 147: *Sebastichthys pinniger* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 72.)

1018. S. miniatus Jor. & Gilb.—*Rasciera; Rasher.*

Color above deep vermillion, mottled with flesh-color on the sides, the belly light red; back and sides everywhere with clusters of black dots,

so that the whole body has a dusky shade; top of head and back with vaguely defined cross-blotches made of dark points; three obscure orange stripes radiating from the eye; maxillary with a red streak; lips red, mottled with blackish; under side of head light red, mottled with darker; inside of mouth red; fins all bright vermillion; spinous dorsal spotted with olive-gray below, the membrane posteriorly edged with blackish; soft dorsal spotted below with blackish, a vertical dark olive streak on each membrane; other fins tipped with blackish, the membranes more or less dotted; no black blotch on the spinous dorsal. Body oblong, the form much as in *S. pinniger*. Head moderate, somewhat pointed. Mouth rather large, the maxillary reaching past pupil, its length 2 in head; premaxillary on level of lower edge of pupil; lower jaw projecting somewhat beyond upper, with a moderate symphyseal knob; middle of lower jaw elevated, fitting into an emargination of the upper. Head more completely scaly than in related species, the scales also rougher, the scales on the preorbital and head generally, being fully ctenoid; mandible scaled even to the symphyseal knob, its scales always roughly ctenoid; interopercle fully scaled; most of the branchiostegals with series of scales; maxillary, preorbital, and tip of snout fully scaled; preorbital with a narrow neck; cranial ridges low and small; preocular, supraocular, postocular, tympanic, and occipital spines present; interorbital space very broad, with a slight depression on each side of a median ridge; preopercular spines rather long and sharp, the second the longest, the spines radiating. Gill-rakers, as in *pinniger*, very long and slender, the longest about $\frac{2}{3}$ the diameter of the eye. Dorsal fin low, rather deeply emarginate, about as in *S. pinniger*, but rather higher, the soft rays higher than the spines; caudal fin slightly emarginate; anal fin rather high, the second spine about as long as the third and stouter, little more than half the height of the soft rays, about 3 in head; pectoral fin moderate, the tip reaching about to the vent, the base rather narrow; ventrals very long, usually reaching past the vent, almost to the beginning of the anal. Head $2\frac{3}{4}$; depth 3; pectorals $3\frac{1}{2}$. Dorsal rays XIII–14; A. III, 7; Lat. l. 47. L. 20 inches. San Francisco to San Diego; not rare.

(*Sebastichthys miniatus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 70.)

aaaa. Species with the scales of moderate size; the cranial ridges high; tympanic and postocular spines both present; lower jaw little projecting; anal rays III, 7; scales on head ctenoid; gill-rakers short; second anal spine usually elongate. (*Sebastomus** Gill.)

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* Gill, Proc. U. S. Nat. Mus. 1864, 147: type *Sebastes rosaceus* Grd.

1019. S. ruber (Ayres) J. & G.—*Red Rock-fish; Tambor.*

Color clear deep vermilion red, paler below; a narrow undulating whitish streak along the sides, from the eye to above the base of the anal, and another along the lateral line; these indistinct in the adult; faint dusky shades radiating from eye; fins red, the soft fins always largely blackish at tip, especially in the young; young more distinctly marked than the adults, which are nearly plain brick-red. Body oblong, rather deep, not much compressed. Head large, blunt. Mouth large, the maxillary reaching nearly to posterior edge of eye, its length half that of head; premaxillary on level of lower edge of pupil; lower jaw a little projecting, the symphyseal knob slight. Cranial ridges rather high and sharp, smooth in the young, becoming very rough and broken in the adult; preocular, supraocular, postocular, tympanic, and occipital present; preocular spines triangular; supraocular short, becoming with age divided into a series of irregular spines and tubercles; occipital ridges diverging, likewise divided in adults; interorbital space broad, flattish, coarsely scaled, with 2 slight ridges anteriorly. Eye moderate, $4\frac{1}{2}$ in head; preorbital wide; preopercular spines broad, usually divided, the third multifid. Scales on head rough; jaws naked; suborbital stay weak. Gill-rakers short, clavate, the longest $\frac{1}{4}$ eye. Scales on body rough; accessory scales numerous; pectoral short, broad, its length 4 in body; dorsal spines stout, rather low, the fin not deeply notched, the longest spine about as high as the soft rays, $2\frac{1}{2}$ in head; caudal truncate; soft fins scaly; second anal spine little stronger or longer than the third, $\frac{2}{3}$ height of soft rays, $2\frac{2}{3}$ in head. Peritoneum white. Head 3; depth $2\frac{2}{3}$. D. XIII–14; A. III, 7; Lat. l. about 50. L. 30 inches. Pacific coast, from Santa Barbara northward, abundant; reaches a larger size than any of the others, except possibly *S. paucispinis*.

(*Sebastes ruber* Ayres, Proc. Cal. Acad. Sci. i, 7, 1854, and 1862, 215.)

1020. S. constellatus Jor. & Gilb.

Orange-red; back olive shaded; belly yellowish; cheeks with red and yellowish shades; head and body everywhere closely covered with small roundish pale spots; spots above light rose color; below larger and nearly white; 4 or 5 roundish rose-colored blotches on the back, besides some mottlings of a similar shade; the first spot, often obscure, under the fourth dorsal spine; the next near the lateral line under the eighth dorsal spine; the third close to the junction of the two parts of the dorsal; the fourth under the end of the soft dorsal; a fifth sometimes near the base of eighth dorsal spine; opercular flap with a rosy

spot; fins light reddish; dorsal speckled at base with light and dark. Body robust, heavy forwards, tapering into a slender caudal peduncle. Head rather pointed in profile. Mouth large, oblique, the lower jaw slightly projecting beyond the emarginated tip of the upper jaw; a small knob at the symphysis; maxillary very broad, extending beyond pupil, its middle part with many small scales, its length 2 in head; premaxillary in front just below the level of the eye; mandible almost entirely covered with small rough scales; muzzle and preorbital scaled to the tip of the snout; head densely covered with small scales. Cranial ridges rather high and narrow; preocular, supraocular, postocular, tympanic, and occipital present; interorbital area concave, with 2 prominent ridges covered by scales; supraocular ridge rather short; occipital ridge long, curved, ending in a sharp spine; preopercle with its second spine long and sharp; preorbital wide, its edge lobed. Eye large, 4 in head. Gill-rakers short, clavate, the longest of them about one-fifth the diameter of the eye. Scales strongly ctenoid, the accessory scales largely developed. Dorsal spines rather strong and low, the fourth more than one-third the length of the head; the fin rather deeply emarginate; soft dorsal rather low, about as high as the second anal spine, $2\frac{3}{4}$ in head, robust, curved considerably longer than the third or the soft rays; caudal slightly emarginate; pectorals rather narrow, reaching beyond ventrals, about to vent, their length two-thirds that of the head. Peritoneum white. Head $2\frac{1}{2}$; depth $2\frac{1}{2}$. D. XIII–13; A. III, 6; Lat. l. 53. L. 15 inches. Coast of California, from San Francisco southward, abundant in deep water; a brilliantly-colored fish.

(*Sebastichthys constellatus* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 295.)

1021. S. rosaceus (Grd.) J. & G.—*Corsair.*

Bright orange red, the young strongly tinged or mottled with golden yellow; back with 4 pale spots, arranged precisely as in *S. constellatus*, *rhodochloris*, and *chlorostictus;* these always very distinct, of a rose-pink color, or sometimes almost white; the darker border around them is of a deep purple or blood color, never greenish; fins rosy, mottled with orange; head with radiating stripes of orange and rosy; nape with alternating bars of yellowish and deep red, the colors blending; no decided green, and no small pink spots anywhere. Body oblong, little elevated. Head rather pointed. Mouth moderate, the jaws about equal, the lower with a small knob; maxillary not reaching posterior border of eye; its length 2 in head; premaxillaries below the orbit.

Eye very large, $3\frac{1}{2}$ in head. Maxillary and preorbital partly scaled; mandible and snout naked. Cranial ridges much as in *S. constellatus*, but more depressed; preocular, supraocular, postocular, tympanic, and occipital present; length of supraocular spine about equal to interorbital width; preopercular spines short. Gill-rakers moderate, longer than in *S. constellatus*, not clavate. Scales moderate, the accessory ones numerous. Dorsal spines rather low and strong, the fourth two-fifths the length of the head, about as high as the soft rays, the fin rather deeply emarginate; caudal slightly notched; anal rather low, with the second spine curved, $2\frac{1}{3}$ in head, much longer and stronger than third, shorter than the soft rays; pectoral fins moderate, reaching beyond tips of ventrals, past the vent, $3\frac{1}{3}$ in body. Peritoneum blackish. Head $2\frac{2}{3}$; depth 3. D. XIII–13; A. III, 6; Lat. l. 48. L. 12 inches. Coast of California, in rather deep water; the most abundant of the red species, and one of the smallest.

(*Sebastes rosaceus* Grd. Proc. Acad. Nat. Sci. Phila. viii, 146, 1854, and in U. S. Pac. R. R. Surv. Fish. 78, pl. 21 (poor figure, from a specimen in bad condition): *Sebastes helvomaculatus* Ayres, Proc. Cal. Acad. Sci. ii, 26, f. 8, 1859: *Sebastes rosaceus* Günther, ii, 93.)

1022 S. rhodochloris Jor. & Gilb.—*Fly-fish.*

Bright clear rose-red, without trace of purplish; region above lateral line with much deep green in the form of reticulating streaks; below the lateral line the green gives place to bright golden yellow similarly mixed with red; top of head with cross-bands of green and red; green streaks radiating from the eye; four bright pale pink spots on the sides of the back, arranged precisely as in *rosaceus*, *constellatus*, and *chlorostictus*, the color brighter than in these, surrounded by rings of green, without any trace of purplish shading; a pink opercular spot; a pale area behind eye; fins all with the rays red, the membranes olive or golden. Body oblong, more elongate than in related species; maxillary $2\frac{1}{6}$ in head, reaching beyond pupil; jaws about equal; preorbital narrow. Eyes very large, $3\frac{1}{2}$ in head. Cranial ridges higher and sharper than in any other of the red species; preocular, supraocular, postocular, tympanic, and occipital species present; interocular space very narrow, its width less than length of supraocular spine; two sharp ridges extending lengthwise of it; preopercular spines long. Gill-rakers as in *rosaceus;* mandible finely scaled near the base. Dorsal fin moderately emarginate, lower than in *rosaceus*, the longest spine nearly 3 in head; soft dorsal as high as spines; caudal slightly notched; second anal spine longer than in any other species, longer than maxillary, higher than the soft rays, half length of head; pectoral reaching past

ventrals, nearly to anal, $3\frac{2}{3}$ in body. Peritoneum dusky. Head $2\frac{1}{2}$; depth 3. D. XIII–14; A. III, 6; Lat. l. 58, the accessory scales very numerous. L. 12 inches. Off Monterey and San Francisco, in deep water; rather rare.

(*Sebastichthys rhodochloris* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 144.)

1023. S. chlorostictus Jor. & Gilb.—*Pesca Vermiglia.*

Olivaceous above, sides pinkish and golden; four roundish spots of pink placed as in *S. constellatus* and *S. rosaceus*, but less distinct; a pink blotch on opercular flap; the upper parts of the body, from just below the lateral line, closely covered with small round spots of a clear olive-green; these spots most distinct on the back and the top of the head; on the sides of the body, just above and below the lateral line, these spots form two continuous series, following the course of the lateral line; eyes above with green spots; fins nearly plain red; base of dorsal spotted with olive. Body oblong. Head moderate, the profile rather steep, with a nearly even slope Mouth large, oblique, the maxillary reaching to behind the pupil, its length about $2\frac{1}{5}$ in head; the premaxillary in front below the level of the large eye, which is $3\frac{1}{2}$ in head. Jaws equal in the closed mouth, the tip of the lower fitting into the emarginate upper jaw; a rather conspicuous symphyseal knob. Preorbital sinuate. Cranial ridges sharp and high, ending in sharp spines, about as in *constellatus;* preocular, supraocular, postocular, tympanic, and occipital present. Inteorbital space concave, with two rather prominent ridges. Preopercular spines rather sharp, the second longest; opercular spines sharp. Gill-rakers long and rather strong, not clavate, the longest about two-fifths the diameter of the eye, longer than in related species. Scales on head fewer than in *S. constellatus;* the snout wholly naked; maxillary partly scaled; mandible naked. Dorsal spines very high, nearly as high as in *vexillaris;* the fourth highest, nearly half head, higher than the soft rays, which are also considerably elevated. Dorsal fin rather deeply emarginate; caudal fin emarginate; anal fin not very high, its second spine much higher and stronger than the third, about as high as the soft rays, $2\frac{1}{4}$ in head; pectorals $3\frac{1}{3}$ in length, with moderate base, reaching beyond tips of ventrals, about to vent. Head $2\frac{1}{2}$; depth $2\frac{3}{4}$. D. XIII–13; A. III, 6; Lat. l. 50. L. 15 inches. Off Monterey and San Francisco; abundant in deep water.

aaaaa. Species with the lower jaw projecting and scaly; the postocular spine wanting; the body elongate; the peritoneum dusky; otherwise as in the preceding group.

1024. S. elongatus (Ayres) J. & G.—*Reina.*

Color light red; sides above with irregular horizontal interrupted olive-green bands, which are more or less broken into blotches, two of these bands below the lateral line, becoming confluent behind; a distinct pale band following the course of the lateral line; upper fins blotched with olive, lower pale red; head olive and blotched above, pale red below; chin black. Body more elongate than in any of the other species (except *paucispinis*), compressed. Head long, rather pointed. Mouth large; maxillary extending to posterior margin of pupil, its length $2\frac{1}{4}$ in head; premaxillary on level of lower margin of orbit; lower jaw strongly projecting. Eye very large, longer than snout, $3\frac{1}{3}$ in head; interorbital space broad, concave, with low frontal ridges. Cranial ridges low and long; preocular, supraocular, tympanic, and occipital present; tympanic spines small; preopercular spines very sharp, all pointed, directed backwards; opercular spines very long and sharp. Gill-rakers long and strong, the longest about one-third the eye. Scales large, not very rough; accessory scales numerous. Maxillary, mandible, and preorbital scaly. Dorsal spines moderately high, rather strong, the highest about equal to the soft rays, $2\frac{3}{4}$ in head; the fin not deeply emarginate. Caudal fin lunate; anal fin rather low; the second spine half length of head, much longer than the third, higher than the soft rays; pectorals moderately broad, long, reaching beyond the tips of the short ventrals to vent. Peritoneum dusky. Head $2\frac{2}{5}$; depth $3\frac{1}{3}$; pectoral $3\frac{1}{3}$. D. XIII–13; A. III, 6; Lat. l. 58. L. 12 inches. About Monterey and San Francisco; abundant in deep water. This species bears considerable resemblance to *S. proriger*.

(*Sebastes elongatus* Ayres, Proc. Cal. Acad. Sci. ii, 25, 1859, f. 9.)

aaaaaa. Species with the scales of moderate size; the cranial ridges well developed; the postocular wanting; scales smoothish; those on the head mostly cycloid; lower jaw naked, its tip protruding; peritoneum white; second anal spine long.

1025. S. rubrivinctus Jor. & Gilb.—*Spanish Flag.*

Very pale rose-red, almost white, with cross-bands of a deep, intense crimson-red; these bands broadest on the back; one of the bands runs across the eye, snout, suborbital and maxillary, its boundaries indistinct; the next across the nuchal region, front of dorsal and opercle; the next across the middle of the spinous dorsal, including the ventrals and the postrior half of pectorals; another across soft dorsal and anal; another across base of caudal, the fin itself being deep rose color; the other fins share the color of that part of the body against which they

lio. Body robust, rather deep and compressed. Head long, acute in profile, there being a nearly straight slope from a bony prominence in front of the spinous dorsal to the tip of the lower jaw. Mouth rather large, oblique, the lower jaw projecting; maxillary broad, extending to opposite the middle of the eye; its length $2\frac{1}{4}$ in head; premaxillary on level of lower border of eye; cranial ridges quite low, their spines bluntish and depressed; preocular, supraocular, tympanic, and occipital ridges present; interorbital space flattish, narrow, not so broad as the eye, not widened behind, with sparse, smooth scales; two long frontal ridges extend the length of the interorbital space; these are covered with bare skin; behind and between these are two shorter ridges covered by naked skin; occipital ridges long, curved, diverging behind; mandible naked; maxillary with a few scales; suborbital stay very prominent, its tip nearly reaching the preopercle; preopercular spines very strong, the second longest; opercular spines long; preorbital wide. Eye very large, its diameter $3\frac{3}{4}$ in length of head. Gill-rakers rather short, robust, much compressed, the longest about one-fourth the length of the eye. Scales on head all small and thin, mostly cycloid; scales of body smoother than usual; accessory scales very numerous. Dorsal spines robust, rather high, the fifth not quite half the length of the head; those behind rapidly shortened, the membrane joining the thirteenth spine below its middle; soft rays about as high as spines; caudal slightly emarginate; anal low, its second spine $2\frac{1}{2}$ in head, much longer and stronger than third, both robust; pectorals moderate, not reaching vent, $3\frac{2}{3}$ in length; the base equal to diameter of eye; ventrals not reaching tips of pectorals. Peritoneum white. Head $2\frac{1}{2}$; depth $2\frac{1}{3}$. D. XIII–12; A. III, 7; Lat. l. 55. L. 15 inches. Santa Barbara to Monterey, in deep water; rare. In life, the most brilliantly colored large fish in our waters.

(*Sebastichthys rubrivinctus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 291.)

aaaaaaa. Species with the scales of moderate size, the cranial ridges strong and mostly high, but not sharp, the postocular wanting; the jaws nearly equal, the lower naked; the gill-rakers short; the pectorals broad, with thickened lower rays; anal III, 5 to III, 7. (*Sebastichthys** Gill.)

1026. S. auriculatus (Grd.) J. & G.

Color blackish brown, much mottled with light brown; top of head dark; a dark blotch on the upper angle of the opercle; entire body flushed with brownish red, this color most noticeable on front of head;

*Gill, Proc. Acad. Nat. Sci. Phila. 1862, 278: type *Sebastes nigrocinctus* Ayres: (σεβαστος, magnificent; ἰχθύς, fish.)

a brownish red streak along middle of maxillary, and a second from the preorbital downwards and backwards across the cheek; another from eye to lower part of opercle; fins all marked with dark and light olive and reddish, the latter hue especially on the ventrals and anal; base of pectoral blackish; northern specimens are more blackish, and less uniform in color; old specimens are often nearly uniform reddish brown; the young sometimes with obscure dark bars, the caudal fin speckled. Body oblong; rather deep. Mouth moderate, below axis of body, the jaws nearly equal; maxillary reaching beyond eye, its length $2\frac{1}{8}$ in head; preorbital broad; interorbital space concave on each side of a broad median ridge; preocular, supraocular, tympanic, coronal, and occipital spines present, the latter sometimes divided; preopercular spines long, all directed backward, the second longest; opercular spines weak; 3 suprascapular spines. Scales on body large, ctenoid; accessory scales not very numerous; mandible naked. Spinous dorsal high, the longest spine 2 in head, higher than the soft rays, which are much elevated; second anal spine longer and stronger than third, $2\frac{1}{3}$ in head; soft part of anal high; pectorals rather short and broad, the tips barely reaching the vent, their length $3\frac{1}{2}$ in body; ventrals reaching to vent; caudal truncate. Head $3\frac{1}{5}$; depth $2\frac{1}{2}$. D. XIII, 13; A. III, 7; Lat. l. 45. L. 18 inches. Pacific coast, from Vancouver's Island to Cerros Island, very abundant; the only species entering the bays and caught with hook and line from the wharves. It may be known at once by the coronal spines, which are developed on no other American species of the genus. In some of our specimens from the Gulf of Georgia these spines are obsolete on one or both sides.

(*Sebastes auriculatus* Grd. Proc. Acad. Nat. Sci. Phila. 1854, 131, 146, and U. S. Pac. R. R. Surv. Fish. 80: *Sebastes auriculatus* Ayres, Proc. Cal. Acad. Sci. 1862, 215, f. 68: *Sebastes ruber* var. *parvus* Ayres, Proc. Cal. Acad. Sci. i, 7, 1854.)

1027. S. rastrelliger Jor. & Gilb.—*Grass Rock-fish.*

Blackish green, with paler mottlings, the sides spotted with darker; belly pale greenish; paired fins dark, often bordered with reddish; other fins chiefly olivaceous, spotted with darker; the brightness of the olive and greenish shades is quite variable, but the species is always without definite markings and without bright red. Body oblong, deepest at the shoulders. Head short, blunt. Mouth moderate, little oblique, the maxillary reaching to the posterior margin of the eye, its length $2\frac{1}{5}$ in head; the premaxillary rather below the level of the eye; jaws equal, without symphyseal knob. Eye small, anterior, $4\frac{1}{2}$ in head. Cranial ridges

strong, but broad and depressed, ending in small spines; preocular, supraocular, tympanic and occipital present; the occipital ridges are very long, equalling the diameter of the orbit; preopercular spines short and stout, the two upper subequal; opercular spines very broad and flat, sometimes bifid; suprascapular spines strong; interorbital space moderate, narrower than eye, flattish, with two low ridges; spines of head little divergent backwards. Gill-rakers very short, wide, compressed, the longest almost as wide as high. Scales on body large; accessory scales few. Dorsal spines low, the fifth about two-fifths the length of the head; the fin little emarginate; soft rays considerably higher than spines; caudal slightly rounded; anal high, its spines low, the second as high as the third and much stouter, 3 in head; pectoral rather short, reaching vent, its base extremely broad, its width about one-third length of head; the lower rays much thickened; length of pectorals $3\frac{2}{3}$ in body; ventrals moderate, not quite reaching the tips of the pectorals. Peritoneum brownish. Head 3; depth $2\frac{3}{4}$. D. XIII–13; A. III, 6; Lat. l. 47. L. 15 inches. Coast of California; abundant southward. A strongly marked species, known at once by its short gill-rakers.

(*Sebastichthys rastrelliger* Jor. & Gilb. Proc. U. S. Nat. Mus, 1880, 296.)

1028. S. caurinus (Rich.) Jor. & Gilb.

This form agrees with the subspecies *vexillaris*, in general characters, differing in the color, which is scarcely reddish or yellowish, the dark shades being dark brown, the pale shades light brownish and better defined than in *vexillaris;* the chin is rather more projecting; the dorsal spines are slender and much lower than in *vexillaris;* in this respect there is considerable variation among individuals; the armature of the head is essentially the same as in *vexillaris*, as are the fin-rays, gill-rakers, and scales. Puget Sound to Sitka; abundant.

(*Sebastes caurinus* Richardson, Voy. Sulphur. Ichth. 77, pl. 41, f. 1, 1845. This species has no special affinity with the Japanese *S. inermis*, with which it has been identified by Dr. Günther.)

Subsp. **vexillaris** Jor. & Gilb.—*Garrupa.*

Bright pale yellowish-red, becoming lighter below, the reddish and yellowish forming large and irregular areas, sometimes one shade predominating, sometimes the other; a pink cross-blotch on the back at base of the second and third dorsal spines sometimes present; upper parts of head mostly pink, with broad olive shades running backward, one on the lower lip, one on the maxillary, one from preorbital region downward, one from the eye backward and downward across the cheeks,

and another across the opercular spines; fins all pinkish red, the membranes olive; vertical fins narrowly edged with dusky; top of head usually with alternating cross-shades of pinkish and yellowish; yellowish shades sometimes replaced by light olive; other specimens are quite red; still others brownish; the light areas on the back have a position similar to that of the rosy spots in *S. constellatus*. Body stout and compressed, the back elevated. Mouth rather large, the broad maxillary extending behind the orbit, its length 2 in head; premaxillary on level of lower edge of pupil; jaws subequal, the lower somewhat projecting, but without symphyseal knob; the upper jaw emarginate at tip. Cranial ridges long and low, higher than in *rastrelliger*, the preocular, supraocular, occipital,and sometimes tympanic present; preocular spines conspicuous, extending well backward; occipital spines rather long, diverging backward; interorbital space broad and flattish, narrower than eye, occupied by two raised ridges, covered by the scales; preopercular spines moderate, some of them usually divided into two, three, or four at tip, the middle one the largest. Eye moderate, high up, 4–4½ in head; preorbital very broad; suborbital stay short. Jaws naked. Gill-rakers rather long and strong, the longest slightly clavate, nearly half as long as eye. Dorsal spines very strong and high, about as in *chlorostictus*, nearly as high as in *maliger*, the highest more than half length of head, and rather higher than the very high soft rays; membrane of spinous dorsal rather deeply incised, but less so than in *maliger;* second anal spine 3 in head, scarcely longer than the third, and not much stronger, about two-thirds as high as the soft rays; caudal truncate; pectoral shorter than head, not reaching the vent; its base rather broad, its length 3¾ in body; ventrals not reaching vent. Peritoneum white. D. XIII–16; A. III, 6; Lat. l. 55. L. 18 inches. Coast of California, abundant southward; apparently a geographical variety of *S. caurinus*, but quite different in color.

(*Sebastichthys vexillaris* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 292.)

1029. S. maliger Jor. & Gilb.

Color warm yellowish brown, the anterior portion of the back and sides usually clear yellow; breast yellow; anterior part of body and head, especially in the adult, closely covered with small round spots of a clear orange-brown color; posterior part of body darker than anterior, variously mottled; soft fins all slaty black, the pectorals and dorsal paler at base and speckled; brownish shades radiating from the eyes. Body oblong, robust. Head large. Mouth moderate, the jaws nearly

equal when closed; maxillary reaching to opposite posterior margin of eye, its length about half that of head; preorbital moderate, with an angular lobe. Cranial ridges a little higher than in *caurinus*, a little lower than in *carnatus;* preocular, supraocular, tympanic, and occipital present; occipital ridges low; preopercular spines very short; opercular long. Gill-rakers moderate, somewhat clavate, about as long as pupil. Scales rough. Jaws naked. Dorsal spines very high and strong, higher than in any other species, the membranes very deeply incised, so that half or more of the length of the highest spines is free anteriorly; highest spine about $\frac{5}{8}$ length of head, the fin deeply emarginate; soft dorsal high, but lower than the spines; caudal truncate; anal high, the second spine $2\frac{1}{3}$ in head, little higher than the third, not two-thirds the height of the soft rays; pectorals very broad and rounded, reaching beyond ventrals to vent; base of the fin broader than eye, the lower rays thickened; its length $3\frac{1}{2}$ in body. Peritoneum pale. Head $2\frac{3}{5}$; depth $2\frac{1}{4}$. D. XIII–13; A. III, 6; Lat. l. 47. L. 20 inches. Monterey to Sitka, mostly in deep water, very abundant northward; one of the largest species.

(*Sebastichthys maliger* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 322.)

1030. S. carnatus Jor. & Gilb.

Yellowish brown, with blotches of clear flesh-color or pinkish, the dark color predominating above, the pinkish below; membrane between third and fourth spines always pale, this color forming a blotch at the base of these spines, and then extending obliquely downwards and backwards, usually joining the ventral color; in front of this light area on the sides is a narrow oblique dark one, in front of which in turn is a pale one, which begins at the angle of the opercle and divides, passing around the pectorals and uniting below them; a light blotch under the eighth dorsal spine, extending up on the fin; another at junction of the two dorsals, and another under the last ray; under each of these are irregular undulating pale areas; sides with pale blotches of all sizes; head above with cross-shades and bands radiating from eye, its light shades tinged with purplish; fins colored like neighboring parts of body. Body rather short and deep. Mouth low and rather short, the maxillary extending to rather behind the posterior edge of the eye, its length 2 in head; premaxillary entirely below eye; jaws about equal; no symphyseal knob. Scales on head rather rougher than in *S. chrysomelas;* lower jaw, maxillary, space in front of eye and nasal region naked. Cranial ridges well developed, but somewhat lower than in *S.*

chrysomelas covered with thick skin; preocular, supraocular, tympanic, and occipital present; occipital spines lower and narrower than in *chrysomelas;* preopercular spines small and bluntish. Gill-rakers short, clavate. Spinous dorsal always higher than in *chrysomelas*, the highest spines 2 in head, rather higher than the soft rays, the membranes more deeply incised than in *chrysomelas;* caudal truncate; anal moderately high, the second spine, $2\frac{3}{4}$ in head, stronger and slightly longer than third, about two-thirds height of soft rays; pectorals rather short, $3\frac{1}{2}$ in head, about reaching to the vent, their bases very broad, the lower rays thickened and fleshy; ventrals reaching vent. Peritoneum white. Head $2\frac{2}{3}$; depth $2\frac{3}{5}$. D. XIII–13; A. III, 6; pyloric cœca 8; vertebræ 12 + 15; Lat. l. 43. L. 14 inches. Coast of California, generally abundant; in rather shallow water.

(*Sebastichthys carnatus* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 73.)

1031. S. chrysomelas Jor. & Gilb.

Pattern of coloration precisely as in *S. carnatus*, the colors different; light shade a clear, warm, brownish yellow, with some specks of deeper orange; varying from a dusky orange to olivaceous yellow, the latter color more often seen on the belly; dark shade, black or dark brown, with slight olive tinge; dark color predominating on the back; membrane between third and fourth dorsal spines and an area at the base of these spines always pale; a yellow blotch extending thence downward and backward, usually joining the light color of the belly; another light area passing from near the angle of the opercle around the pectorals, uniting below them; three other blotches along the back, one under the eighth dorsal spine, one under the last spine, and one under the last soft ray; from each of these, irregular pale areas extend down the sides; fins the color of the region to which they belong; head above with dusky cross-shades and faint bands radiating from the eye. Body short and stout, compressed. Head short, bluntish. Mouth rather small, entirely below the axis of the body; lower jaw slightly included; premaxillaries on level of lower edge of orbit; maxillary reaching posterior margin of eye, its length 2 in head; preorbital wide. Cranial ridges very prominent, high and strong, covered with thick skin, ending in strong spines, which diverge backward; preocular, supraocular, tympanic, and occipital present; preopercular spines short and thick. Gill-rakers as in *S. carnatus*. Scales moderate, rough, the accessory ones few; lower jaw, maxillary, nasal region, and space in front of eye naked. Dorsal spines high and strong, the highest $2\frac{1}{4}$ in head, rather higher than the soft rays, the fin deeply emarginate; second anal spine $2\frac{3}{4}$ in

head, much stronger than third, the two about equal in length; pectoral $3\frac{3}{4}$ in head, with very broad base, reaching beyond the tips of the ventrals, which reach nearly to the vent; lower pectoral rays thickened; caudal truncate. Peritoneum pale. Head $2\frac{3}{4}$; depth $2\frac{3}{4}$. D. XIII, 13; A. III, 6. Lat. l. 45. L.13 inches. San Francisco to San Diego, abundant in rather deep water.

(*Sebastichthys chrysomelas* Jor & Gilb. Proc. U. S. Nat. Mus. 1880, 455, 465.)

1032. S. nebulosus (Ayres) Jor. & Gilb.—*Garrupa.*

Ground color blue-black of varying shade, sometimes tinged with yellowish anteriorly, everywhere finely and irregularly freckled and spotted with yellow or white, the light color usually bright and sharply defined; these spots smallest and most numerous on head; a broad irregular yellow band, made of confluent blotches, from between the third and fourth dorsal spines, involving their membranes, downward to the lateral line, thence backward to base of caudal; fins all black, with light spots at base; under parts soiled yellow. Body robust, the back elevated, the profile steep. Mouth rather large, the jaws equal, the maxillary 2 in length of head, extending to beyond pupil; jaws naked. Eye large. Cranial ridges high and thick, comparatively short; preocular, supraocular, tympanic, and occipital present, the latter much higher than in *chrysomelas*, and bulging so that its base is narrower than its upper part; interorbital space narrow; preopercular spines short. Gill-rakers as in *chrysomelas*. Dorsal rather high, considerably emarginate, the highest spines, 2 in head, higher than the soft rays; caudal truncate; second anal spine $2\frac{1}{2}$ in head, stouter and slightly longer than third, much lower than the soft rays; pectorals short and broad, $3\frac{1}{2}$ in length, reaching beyond tips of ventrals to vent. Scales rough, the accessory scales numerous. Peritoneum pale. Head 3; depth $2\frac{3}{4}$. D. XIII–13; A. III, 7; Lat. l. 49. L. 12 inches. Pacific coast, from Vancouver's Island to Monterey, in rather deep water; abundant.

(*Sebastes fasciatus* Grd. Proc. Acad. Nat. Sci. Phila. 1854, 146, and in U. S. Pac. R. R. Surv. Fish. 79, not of Storer: *Sebastes nebulosus* Ayres, Proc. Cal. Acad. Sci. i, 5, 1854: *Sebastichthys fasciolaris* Lockington, Proc. U. S. Nat. Mus. 1880, 297.)

1033. S. serriceps Jordan & Gilbert.—*Tree-fish.*

Dark olive, blackish above, yellowish below; sides with about 7 oblique black cross-bands, wider than eye, usually sharply defined, but sometimes faint in the young; two black bands downward and backward from eye; lips, mouth, front and lower part of head strongly washed with coppery red; bases of fins with small whitish spots; fins

blackish olive; cranial ridges black. Body robust, compressed behind. Head compressed. Mouth large, the maxillary reaching to opposite middle of eye, its length $2\frac{1}{3}$ in head; jaws equal. Cranial ridges thick, short, high and strong, covered with lax, thick skin, placed nearly in a right line on each side; preocular, supraocular, tympanic, occipital, and nuchal spines usually present, the latter sometimes coalescent with the occipital; interorbital space narrow, flat, closely scaled; preorbital rather broad; preopercular spines sharp; jaws naked; membranes of spinous dorsal thick, covered with small scales. Eye small, 5 in head. Gill-rakers short, stiff and clavate. Dorsal spines strong, rather low, scarcely exserted, lower than the soft rays, the longest $2\frac{2}{3}$ in head; second anal spines $2\frac{1}{3}$ in head, stronger than third, scarcely longer; pectorals broad and rounded, the lower rays thickened, the tips reaching vent; ventrals reaching beyond vent; caudal rounded. Peritoneum pale. Head 3; depth $2\frac{1}{2}$; pectoral $3\frac{1}{2}$. D. XIII–13; A. III, 5; Lat. l. 50. L. 12 inches. San Francisco to Cerros Island, abundant southward; one of the most singularly marked of the rock-fishes.

(*Sebastichthys serriceps* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 38.)

1034. S. nigrocinctus (Ayres) J. & G.

Bright orange-red, with 5 jet-black vertical bars, overlaid with red; these bars comparatively narrow, none of them wider than eye; one at beginning of dorsal, extending downward on opercle and scapular region; a second, broader one, under middle of spinous dorsal; a third under posterior part of spinous dorsal; the fourth narrower, under front of soft dorsal; the fifth under middle of soft dorsal, all of these extending on the dorsal fin; two oblique black bands from eye, downwards and backwards across cheeks; another upwards and backwards towards the nape; fins uniform deep orange, anal and ventrals tipped with blackish; mouth red. Body short, deep, and compressed, deeper than in any of the other species; back arched. Head large, compressed. Mouth very large; maxillary extending to beyond pupil, 2 in head; lower jaw very slightly projecting, the symphysis not produced; premaxillary scarcely below eye. Eye large, $4\frac{1}{4}$ in head. Cranial ridges higher than in any other species, their spines blunt, the ridges arranged in two nearly parallel series as in *S. serriceps*, the surface of the larger ones roughened by accessory spinous tubercles as in *S. ruber;* occipital ridges very high; skin covering cranial ridges thin or obsolete, not lax; interorbital space sparsely scaled, very narrow, its breadth a little more than half diameter of eye, with very strong frontal ridges, which are not covered by the scales; jaws naked; preorbital broad, a low ridge extend-

ing along its surface and that of the suborbital; this ridge, somewhat rough and not covered with the scales, is continuous with the short suborbital stay; preopercular spines short, very blunt, the opercular spines very strong; scapular spines moderate. Gill-rakers short and stout, clavate, the longest nearly one-third the diameter of the eye. Dorsal spines rather high and strong, the longest $2\frac{1}{4}$ in head, about as high as soft rays, the fin not deeply emarginate; caudal fin rounded; anal fin high, its second spine $2\frac{1}{2}$ in head, higher and much stronger than the third; pectorals broad, fan-shaped, $3\frac{2}{3}$ in length, their base one-third broader than the diameter of the orbit, their tips not quite reaching tips of ventrals. Scales rough. Peritoneum white. Head $2\frac{4}{5}$; depth $2\frac{2}{3}$. D. XIII, 15; A. III, 7; Lat. l. 50. L. 15 inches. San Francisco to Vancouver's Island, in deep water; rare southward. A large and singular species.

(*Sebastes nigrocinctus* Ayres, Proc. Cal. Acad. Sci. ii, 25, 1859, and 217, f. 67: *Sebastichthys nigrocinctus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 278.)

359.—SCORPÆNA Linnæus.

Rascacios.

(*Sebastapistes* Gill: *Parascorpæna* Bleeker: *Pseudosebastes* Sauvage: *Pontinus* Poey.)

(Artedi; Linnæus, Systema Naturæ, 1758: type *Scorpæna porcus* L.)

Body oblong, somewhat compressed. Head large, not much compressed, usually naked above, and armed with several series of spinous ridges; often with dermal flaps. Mouth large, with bands of villiform teeth on jaws, vomer, and palatines. Scales mostly ctenoid, of moderate size, often with skinny flaps. Dorsal fin with 12 stout spines; anal with 3 spines, the second commonly the longest; pectorals large, rounded, the base usually procurrent; the upper rays divided, the lower simple in all our species; ventrals inserted behind pectorals. No air-bladder. Vertebræ 10 + 14. Species numerous in the tropical seas; fishes of singular forms and bright colors; the variation in squamation and armature is very great, but if the group be further subdivided, some characters other than those hitherto suggested must be taken. The intergradation of the species of *Scorpæna* and *Sebastodes* is very perfect. The greater number of dorsal spines and of vertebræ afford the only characters known to us by which *Sebastodes* may be distinguished from *Scorpæna*. (σκορπαινα, the ancient name of *Scorpæna scrofa*, from σκορπιος, scorpion, in allusion to the dorsal spines, which inflict a very painful sting-like wound.)

a. Cheeks, opercles, breast, and usually top of head scaly; no pit at the occiput; aspect of *Sebastodes*. (*Pontinus** Poey.)

b. Dermal flaps none; pectoral fin not procurrent; no exoccipital spines.

1035. S. dactyloptera De la Roche.

Color delicate scarlet red, the opercle and dorsal fin somewhat mottled with brownish. Body not much elevated, little compressed, the tail slender. Head large, little compressed; cheeks, opercles, and occipital region well scaled; no dermal flaps anywhere; suborbital stay strong. Mouth rather large, with teeth as usual on jaws, vomer, and palatines; lower jaw not projecting; maxillary extending to beyond pupil. Suborbital with a narrow raised smooth ridge, which ends in a spine at the base of the stay; preorbital narrow, its edge slightly spinous; interorbital space narrow, with two parallel raised ridges and a deep groove. Cranial ridges short, sharp, about as in *Sebastodes rosaceus;* preocular, supraocular, postocular, tympanic, occipital, and nuchal spines present; suprascapular spines sharp; no exoccipitals; opercular spines moderate; preopercular spines sharp, the second longest. Eye very large, 3 in head. Jaws naked. Gill-rakers rather long and slender. Pectoral very narrow for a *Scorpæna*, the rays not procurrent below nor thickened, reaching anal; ventrals small, reaching past vent; anal small and low, its second spine a little stouter but not longer than third; dorsal low, little emarginate, the spines slender. Scales ctenoid, regularly arranged; no accessory scales. Head $3\frac{1}{5}$; depth $2\frac{2}{3}$. D. XII, 12; A. III, 5; Lat. l. 43. Deep water off Chesapeake Bay; described from a specimen lately taken by the U. S. Fish Commission. It is provisionally identified with *S. dactyloptera*, of the Mediterranean and Madeira Islands, but it is probably a species distinct from the latter, although closely related.

(De la Roche, Ann. Mus. xiii, 1809, pl. 22, f. 2: *Sebastes dactylopterus* Günther, ii, 99: *Sebastes imperialis* C. & V. iv, 336.)

aa. Cheeks, opercles, and top of head naked; dermal flaps present; pectorals procurrent, a quadrate pit at the occiput. (*Scorpæna.*)

c. Breast scaly. (*Parascorpæna* Bleeker.)

1036. S. guttata Grd.—*Scorpene; Scorpion; Sculpin.*

Brown, irregularly mottled and blotched with rosy purplish and pale olive; opercles and cheeks, a bar behind eye, and 5 or 6 large blotches at base of dorsal, purplish; head, back, and sides with many small

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*Poey, Memorias Cuba, ii, 172, 1860: type *Pontinus castor* Poey. (Latin, *pons*, bridge; "si l'idée d'un pont formé par les trois premiers sous-orbitaires peut contenter les étymologistes j'en serai bien aise; j'ai déjà dit que les noms les plus savants ne sont pas les meilleurs." Poey.)

round dark olive spots; belly unspotted; thoracic region pink; spinous dorsal blackish, its middle part with many roundish pale spots, forming a continuous stripe, besides smaller black spots; caudal and pectoral with vertical bars of dark and pale spots; soft dorsal and anal spotted; ventrals pinkish, little spotted; jaws and branchiostegals yellowish, more or less mottled; axil pale, with round dark spots. Body robust, little compressed; interorbital space not very deeply concave; a pit at the vertex in front of occipital ridges, much broader than long. Mouth very broad, little oblique, the lower jaw included; maxillary $2\frac{1}{5}$ in head, reaching posterior margin of orbit. Gill-rakers very short, broad, compressed. Cranial spines bluntish, high; preocular, supraocular, postocular, tympanic, occipital, nuchal, and exoccipital present, besides a bifid spine between the exoccipital and orbit; upper preopercular spine longest; opercular spines not large; suprascapular spines 3, knife-like; suborbital region without pit, but with a bony carina on which are 2 or 3 bluntish spines. Head naked; breast, and region before pectorals, covered with small imbedded scales (with exception of opercular flap); anterior margin of preorbitals, margin of preopercle, and nostrils with skinny flaps; 1 or 2 rather small flaps above eye, besides several smaller ones on various parts of the head. Scales small, nowhere distinctly ctenoid; nearly every scale on the upper parts of body with a small membranous flap. Dorsal spines high, higher than the soft rays, the longest $2\frac{1}{5}$ in head; second anal spine longest and much the strongest, 3 in head; pectoral very broad, short, and rounded, its lower rays procurrent, its tip reaching beyond the ventrals to vent, its base more than $\frac{1}{3}$ head, its length $3\frac{1}{2}$ in body; caudal rounded. Peritoneum white. Head $2\frac{2}{3}$; depth 3. D. XII, 10; A. III, 5; Lat. l. 30 (tubes); 50–60 scales. L. 12 inches. Coast of California, from Point Concepcion southward; very abundant.

(Grd. Proc. Acad. Nat. Sci. Phila. 1854, 145; Grd. U. S. Pac. R. R. Surv. Fish. 77, pl. 17: *Sebastapistes guttatus* Gill, in Street's Bulletin, U. S. Nat. Mus. vii, 1877, 62.)

1037. S. plumieri Bloch.—*Rascacio.*

Olive brown, excessively marbled with silvery and reddish; fins profusely variegated; caudal barred with brown and silvery; a dark blotch on spinous dorsal, between the 6th and 7th spines; axil black, with white spots. Body short and thick. Head irregular in form, with numerous grooves and pits, and many fleshy slips; a large deep pit below the eye, between it and the front of suborbital stay; supraocular flap at

least as high as eye; large flaps on preorbital and edge of preopercle, preocular, supraocular, tympanic, coronal, occipital, nuchal, and exoccipital spines present; a deep pit behind coronal spines, as long as broad; preopercular and opercular spines moderate, bluntish, suborbital stay prominent, with 3 or 4 sharp spines; a few scales on preopercle and opercular flap; head otherwise naked; maxillary reaching to behind eye, not quite half head; lower jaw included; breast covered with small imbedded scales; scales of body large, not ctenoid, firm, many of them with membranous flaps; lateral line with a series of fleshy flaps. Dorsal low, the highest spine $2\frac{3}{4}$ in head, somewhat lower than the soft rays; pectorals very broad, procurrent, reaching about to front of anal fin; second anal spine very robust, $2\frac{3}{5}$ in head, much larger than third. Head $2\frac{1}{2}$ in length; depth 3. D. XII, 10; A. III, 5; Lat. l. 25 (rows of scales); about 40 pores. West Indies and both coasts of Mexico; occasional northward. Here described from specimens from Mazatlan, Mexico.

(Bloch. Nya. Handl. Stockh. x, 234, 1789; Bloch & Schneider, 1801, 194: *Scorpæna bufo* C. & V. iv, 306; Günther, ii, 113: *Scorpæna rascacio* Poey, Synops. Pisc. Cubens. 303.)

cc. Breast naked.

1038. S. porcus Linn.—*Pig-foot.*

Reddish brown, much mottled above with darker, and dotted with black; much less variegated than in *S. plumieri;* usually a black blotch on posterior half of spinous dorsal. Body oblong, compressed; back somewhat elevated, highest at origin of spinous dorsal; suborbital stay close to eye, without any pit between it and the eye; supraocular flap broad, a little lower than eye; no flaps on posterior edge of preopercle, four on occipital region, few along lateral line; preocular, supraocular, tympanic, occipital, exoccipital, and nuchal spines present; a pit before occipital spines; opercular and preopercular spines short; maxillary reaching posterior margin of orbit. Scales present on postocular region and upper part of preopercle; scales on body somewhat regularly placed; breast naked. Fins high; pectorals much less procurrent at base than in *S. plumieri*, reaching beyond tips of ventrals, which reach anal; spines slender, the second anal slender, little longer than third. Gill-rakers short and thick. D. XIII, 10; A. III, 5; Lat. l. 40. Southern Europe; a specimen said to have been sent to Cuvier from New York.

(Linn. Syst. Nat.; C. & V. iv, 300; Günther, ii, 107.)

360.—SETARCHES Johnson.

(Johnson, Proc. Zoöl. Soc. Lond. 1862, 11: type *Setarches güntheri* Johnson.)

As here understood, this genus differs from *Scorpæna* in having less than 12 dorsal spines and the scales cycloid, without skinny flaps. Deep-sea fishes. Our species differs from *S. güntheri* in the possession of but ten dorsal spines instead of eleven. (Etymology not obvious.)

1039. S. parmatus Goode.

Body stout and deep. Fins high; vertical fins inserted well back, the paired fins well forward. Interorbital width half the length of the upper jaw, about equal to the orbit. Eye moderate, nearly 4 in head. Scales comparatively large, regularly arranged, cycloid, with concentric furrows and no dermal flaps. Cranial ridges developed about as in *Sebastes*. Preopercular spines very long; caudal truncate. Pectoral fin long, $2\frac{1}{7}$ in body. Head $2\frac{1}{4}$; depth $2\frac{2}{3}$. D. X, 6+; A. III, 6. (*Goode.*) Deep water off Rhode Island; known from a young specimen.

(Goode, Proc. U. S. Nat. Mus. 1880, 480.)

Family CVII (*a*).—COTTIDÆ.

(*The Sculpins.*)

Body moderately elongate, fusiform or compressed, tapering backward from the head, which is usually broad and depressed. Eyes placed high, the interocular space usually narrow; a bony stay connecting the suborbital with the preopercle, usually covered by the skin; upper angle of preopercle usually with one or more spinous processes. Teeth equal, in villiform or cardiform bands on jaws, and usually on vomer and palatines; premaxillaries protractile; maxillary without supplemental bone. Gills $3\frac{1}{2}$ or 4; slit behind the last gill small, or obsolete; gill-rakers short, tubercle-like or obsolete; gill-membranes broadly connected, often joined to the isthmus. Body naked, or variously armed with scales, prickles, or bony plates, but never uniformly scaled. Lateral line present, simple. Dorsal fins separate or somewhat connected, the spines usually slender, the soft part elongate; caudal fin separate, rounded; anal fin similar to the soft dorsal, without spines; pectoral fins large, with broad procurrent bases, the rays mostly simple, the upper sometimes branched; ventrals thoracic, rarely entirely wanting, the rays usually less than I, 5. Pseudobranchiæ present, at least in all our species. Pyloric cœca usually in small number (4–8); air-bladder commonly wanting. Genera about 40; species about 150, mostly of the rock pools

and shores of northern regions; many species found in fresh waters. The group, as here understood, comprises a considerable variety of forms, and is very difficult to define, as it grades into the *Liparididæ* on the one hand, and into the *Scorpænidæ* on the other. Most of the species are of small size and singular aspect, and none are valued as food. The genera have been probably too much multiplied, and several of them can be only provisionally accepted.

(*Triglidæ*, group *Cottina*, pt.; group *Scorpænina*, part, Günther, ii; family *Psychrolutidæ* Günther, iii, 516, 517.)

a. Spinous dorsal longer than soft part, of more than 14 spines. (*Hemitripterinæ*.)
  b. Spinous dorsal deeply notched, the anterior spines highest; skin rough, with prickles and tubercles; teeth on vomer and palatines; gill-membrane free from isthmus; no slit behind last gill.
    HEMITRIPTERUS, 361.

aa. Spinous dorsal shorter than soft part, of less than 13 spines.
  c. Ventral fins wanting. (*Ascelichthyinæ*.)
    d. Skin naked; no slit behind fourth gill; gill-membrane free from isthmus; teeth on vomer and palatines.
      ASCELICHTHYS, 362.

  cc. Ventral fins present.
    e. Spinous dorsal little developed, continuous with the soft dorsal, the spines slender, concealed in the loose naked skin; gill-membranes broadly joined to the isthmus; no slit behind last gill. (*Psychrolutinæ*.)
      f. Vomer and palatines toothless ..... PSYCHROLUTES, 363.
      ff. Vomer with teeth ..... COTTUNCULUS, 364.

ee. Spinous dorsal not concealed.
  g. Gill-openings extending below at least to the base of lowest pectoral ray. (*Cottinæ*.)
    h. Slit behind last gill obsolete*; vomer with teeth.
      i. Gill-membranes broadly united to the isthmus, not forming a fold across it; head feebly armed; palatine teeth few or none.
        URANIDEA, 366.
      ii. Gill-membranes free from isthmus, or else forming a broad fold across it; head well armed.
        j. Palatine teeth well developed; body usually more or less scaly ..... ICELUS, 365.
        jj. Palatine teeth none; body without true scales .... COTTUS, 367.
    hh. Slit behind last gill evident.
      k. Vomer without teeth; preopercular spine with antler-like processes; gill-membranes forming a fold across isthmus ... GYMNACANTHUS, 368.

    kk. Vomer with teeth.
      l. Skin not hispid.†

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*A round pore in some species of *Cottus*.
†Partly villous in *Triglops*.

m. Palatine teeth none.
n. Gill-membranes more or less joined to the isthmus, sometimes forming a fold across it.
o. First dorsal spine not elevated.
p. Preorbital strongly cavernous; intestinal canal short; spines of head short; fresh water .....TRIGLOPSIS, 369.
pp. Preorbital little canvernous; intestial canal short; spines of head long; marine. (Subgenus *Oncocottus*).....COTTUS, 367.
ppp. Preorbital not cavernous; intestinal canal elongate; lateral line with a series of large bony plates .....ENOPHRYS, 370.
oo. First dorsal spine elevated; skin perfectly smooth; intestinal canal short..LIOCOTTUS, 371.
nn. Gill-membranes free from isthmus; sides below with oblique series of minute prickly scales; series of plates along back and along lateral line.....TRIGLOPS, 372.
mm. Palatine teeth present.
q. Gill-membranes joined to the isthmus, sometimes forming a narrow fold across it.
r. Skin perfectly smooth; preopercular spine with antler-like processes; spinous dorsal short, entire.....LEPTOCOTTUS, 373.
rr. Skin with bands of rough scales; preopercular spine simple; spinous dorsal long, emarginate .....HEMILEPIDOTUS, 374.
qq. Gill-membranes entirely free from the isthmus.
s. Sides of back with a band of rough scales; ventral fins very long, armed with setæ.
MELLETES, 375.
ss. Sides of back without band of scales.
t. Ventrals I, 5; spinous dorsal long.
SCORPÆNICHTHYS, 376.
tt. Ventrals I, 3; spinous dorsal short.
OLIGOCOTTUS, 377.
ll. Skin everywhere rough with villiform prickles; first dorsal elevated in front; head small, with vertical cheeks.
u. Gill-membranes free from the isthmus; ventrals small .....BLEPSIAS, 378.
uu. Gill-membranes united to the isthmus; ventrals well developed.
NAUTICHTHYS, 379.
gg. Gill-opening restricted to the space above the upper edge of the base of the pectoral; skin everywhere with bifid or trifid prickles. (*Rhamphocottinæ.*)
v. Snout produced; mouth very small; no teeth on vomer or palatines; head elevated, with two bony ridges.
RHAMPHOCOTTUS, 380.

361.—HEMITRIPTERUS Cuvier.

Sea Ravens.

(Cuvier, Règne. Anim. ii, 1829, ed. 2: type *Hemitripterus americanus* C. & V.)

Body moderately elongate, scaleless, but the skin covered with prickles and bony protuberances of various sizes and forms. Head large, with numerous bony humps and ridges and fleshy slips above; orbital rim much elevated, the interorbital space deeply concave; a depressed area at the occiput, behind which are two blunt spines on each side. Mouth very wide; jaws, vomer, and palatines with broad bands of teeth; no slit behind last gill; gill-membranes broadly united, free from the isthmus; preopercle with stout, blunt spines; suborbital stay very strong, forming a sharp ridge. Spinous dorsal much longer than the soft part, of 15 to 18 spines, of which the first two are the highest, and the fourth and fifth shorter than the succeeding ones, the fin thus deeply emarginate; pectoral fins very broad, much procurrent; ventrals I, 3. Large fishes of singular appearance, inhabiting the North Atlantic and Pacific. (ἡμῖ, half; τρεις, three; πτερὸν, fin.)

1040. H. americanus (Gmelin) Cuv. & Val.—*Sea Raven.*

Reddish brown, marbled with darker brown, and much variegated; yellowish below; fins variegated with light and dark. Body villous, the prickles enlarged and tubercle-like along back and lateral line; nasal spines strong; supraocular ridge much elevated, with dermal flaps and two blunt spines; two pairs of fleshy slips on nasal bones, and two on supraocular ridges; smaller cirri on maxillary, on preorbital, and several on lower jaw; interocular space very deeply concave; two blunt occipital spines on each side, outside of which are two or three others; opercle small, with a bony ridge; preopercle with two blunt spines, below which are one or two others; lower jaw slightly projecting; maxillary reaching beyond eye, about half head; pectorals nearly reaching anal; highest dorsal spine $1\frac{2}{3}$ in length of head, as long as caudal; ventrals reaching half way to anal. Head $2\frac{2}{3}$; depth $3\frac{3}{4}$. D. IV, XII–I, 12; A. 13; Lat. l. 40. Atlantic coast of America; chiefly northward from Cape Cod.

(*Scorpæna americana* Gmel. Syst. Nat. 1788, 1220: *Cottus acadian* Walbaum, Artedi Pisc. 1792, 392; Cuv. & Val. iv, 268; Günther, ii, 143: *Hemitripterus acadianus* Storer, Hist. Fish. Mass. 35.)

1041. H. cavifrons Lock.

Very similar to the preceding, but with the upper surface of the head more uneven, the concavity of the interocular area more marked, and the dorsal fin with more spines. Head equalling depth, about 3½ in total length with caudal. D. IV, XIV–13; P. 20; V. I, 3; A. 14; Lat. l. 44. L. 16 inches. Kodiak, Alaska; perhaps not distinct from the preceding.

(Lockington, Proc. Acad. Nat. Sci. Phila. 1880, 233: ? *Cottus villosus* Pallas, Zoogr. Ross.-Asiat. iii, 129, 1811.)

362.—ASCELICHTHYS Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 264: type *Ascelichthys rhodorus* Jor. & Gilb.)

Body plump, fusiform, tapering backward, covered with loose smooth skin; head broad, depressed, its upper surface evenly and weakly convex; a hooked preopercular spine; no nasal spines; a supraorbital cirrus; teeth on jaws, vomer and palatines; no slit behind fourth gill; gill-membranes broadly united, free from the isthmus; spinous dorsal low; the spines slender, almost concealed in the membrane; pectorals broad; *ventral fins wanting*. Small fishes of the rock pools of the North Pacific. (*a*, privative; σκελος, leg; ἰχθύς, fish.)

1042. A. rhodorus Jor. & Gilb.

Dark olivaceous, sometimes with saddle-like pale blotches; lips rosy; spinous dorsal dusky, edged in life with bright crimson; other fins dusky, edged with paler, the pectoral slightly barred. Head low, rounded anteriorly; maxillary reaching to posterior border of eye. No scales, prickles, or barbels anywhere, except a fringed cirrus over the eye; preopercle with a short, simple, strongly hooked spine; spines directed downwards and forwards on subopercle and interopercle; lateral line continuous. Dorsal fins connected by membrane, the spines low, weak, nearly uniform; soft dorsal nearly twice as high as spinous; pectorals about reaching vent. Head 3; depth 5. D. IX–19; A. 15; P. 16. L. 5 inches. Pacific coast; Sitka to Cape Mendocino; abundant among rocks between tide-marks.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 264.)

363.—PSYCHROLUTES Günther.

(Günther, Cat. Fish. Brit. Mus. iii, 516, 1861: type *Psychrolutes paradoxus* Günther.)

Body tadpole-shaped, tapering from the head to the very slender tail, covered with very loose, naked, movable skin. Head large, depressed,

flattish above; snout obtuse, rounded; interocular space very broad, concave, the ocular ridges obsolete; lower jaw projecting; maxillary entirely adnate to the skin of the preorbital; jaws with bands of villiform teeth; no teeth on vomer or palatines; no spines or cirri about the head; suborbital stay narrow, not reaching preopercle. Gill-membranes united to the isthmus; gills 3½, no slit behind the fourth. Branchiostegals 7. Fins connected; spinous dorsal of short, slender, flexible spines, imbedded in the skin and scarcely visible; soft dorsal short, the rays close together; anal low; caudal separate; pectoral fins long, with a broad, procurrent base. Ventrals rather long, I, 3, close together, distinct, the base adnate to the body. Small fishes, closely resembling *Liparididæ*, from which group they are distinguished by no character of much importance. (*ψυχρολουτης*, one who bathes in cold water.)

1043. P. paradoxus Gthr.

Dusky, pale below; sides of head with round pale spots (mucous pores); top of head with dark obscure streaks. Body almost fusiform, tapering from the shoulders to the very slender tail. Head very large, depressed, its bones thin; interocular space two-fifths length of head. Mouth large, the maxillary extending to below posterior margin of eye; premaxillary on the level of pupil; two blunt tubercles behind eye; no spines about head; processes of premaxillary very prominent; isthmus broad. Dorsal long, the spines separated by an emargination from the soft rays, the spines very slender, weak and wide apart, enveloped in thick skin; soft rays close together, much higher than the spines; caudal short, rounded; anal fin similar to soft dorsal, but lower; ventrals about half as long as the pectorals, their rays about I, 3. Head 2⅔; depth 4½. D. VIII–9; A. 9; C. 12; B. 7. North Pacific; this description taken from a specimen examined by us from Kodiak; the original type from the Gulf of Georgia.

(Günther, iii, 516.)

364.—COTTUNCULUS Collett.

(Collett, Norges Fiske, 1875, 20: type *Cottunculus microps* Collett.)

Tadpole-shaped, the head extremely large, the body tapering rapidly from the shoulders to the slender tail; mouth rather large, terminal, oblique, the jaws about equal; villiform teeth in the jaws; a double patch on vomer; no teeth on the palatines; no spines on the head, the tubercular surface of the skull covered by skin; skull thin, its bones

not firm. Gills 3½, no slit behind the last arch; gill-membranes broadly joined to the isthmus, their union extending to above the lower edge of the base of the pectorals. Pseudobranchiæ very small; no cirri, scales, or prickles; the skin thin and movable, smooth, or roughened with small warts. Spinous dorsal little developed; the two fins usually continuous; spines very slender, flexible, imbedded in the skin; pectorals short, procurrent below; ventrals very short, well separated, their rays I, 3; caudal rounded. Deeper parts of the Atlantic; very closely related to *Psychrolutes*. (A diminutive of *Cottus*.)

1044. C. microps Collett.

Pale, with three broad dusky cross-bands on body and fins, one on head, one through spinous dorsal and pectoral, one through second dorsal and anal, besides a small band at base of caudal. Head very large, its length, breadth, and depth nearly equal; the greatest depth at the nape; four bony tubercles on top of head and some at the sides, all covered by the skin; lower jaw included; maxillary extending to below the middle of the eye, which is equal to the snout, and about 4½ in head; suborbital stay and the roughish edge of the preopercle both covered by smooth skin; chin and preorbital with pores. Skin everywhere thin, somewhat movable, its surface roughened by small blunt warts. Dorsal fin continuous, the feeble spines lower than the soft rays; pectorals barely reaching anal; caudal long. Head 2⅔; depth 3½. D. VI–19; A. 10. L. 8 inches. Deep water off the coasts of Norway and of Rhode Island; lately taken by the United States Fish Commission. The specimens here described by us differ somewhat from Collett's description, but the very small size of the original types may perhaps account for the discrepancies.

(? Collett, Norges Fiske, 1875, 20, pl. 1; Goode, Proc. U. S. Nat. Mus. 1880, 479.)

1045. C. torvus Goode.

Color yellowish, the fins all dusky; no cross-bars. General form and appearance of *C. microps*, but the head still larger, and the skin perfectly smooth, very thin, loose, and movable as in *Liparis*. Tubercles on head stronger, more numerous, covered by skin, but more spine-like, the bones firmer; spinous dorsal still feebler and more concealed. Head 2½; depth 3½. D. VII–14; A. ca. 15. L. 6 inches. Deep water off the coast of Rhode Island; lately taken by the United States Fish Commission.

(Goode, Proc. U. S. Nat. Mus. 1880, 479; name only.)

365.—ICELUS Kröyer.

(Kröyer, Naturhist. Tidsskr. i, 253, 1844: type *Icelus hamatus* Kröyer.)

Body fusiform, naked, or variously covered with rough scales or plates, which are permanent and alike in both sexes; skin otherwise smooth. Mouth rather large; teeth on vomer and palatines. Head naked or scaly, usually with cirri; preopercular spine hooked, branched, or forked. Gill-membranes broadly united, free from the isthmus; no slit behind fourth gill; ventral rays I, 3. North Atlantic and Pacific; the species differing greatly in appearance and armature. (εἰκελος, resembling.)

* Skin more or less scaly.
  a. Spinous dorsal not emarginate.
    b. Top of head and interorbital area convex and nearly smooth; head naked. (*Artedius** Girard.)

1046. I. lateralis (Grd.) J. & G.

Dark clear olive-green; head reddish-shaded, the back with sharply defined cross-blotches, alternately dark olive and pale; lower half of sides usually with numerous small pale spots; belly bluish; fins barred with different shades of olive, reddish brown, and black; northern specimens with a black spot on the front of the spinous dorsal; below it a scarlet crescent, bordered with yellow. Body rather slender, little compressed. Head long and low, less deep than in the other species; occipital region almost flat; interocular space much narrower than the eye. Eye shorter than snout, nearly 5 in head; skin of head everywhere perfectly smooth, its upper surface with numerous small conspicuous pores, and many slender small cirri; no distinct supraorbital cirrus, and no occipital ridges; nasal spines small. Mouth very large, the jaws nearly equal, the maxillary extending to below the posterior edge of the eye, its length about half that of the head; preopercular spine very small, covered with the skin, forked at tip. Dorsal band of scales narrow, of about 8 rows anteriorly, 2 or 3 posteriorly. Lateral line anteriorly, with small cirri. Dorsal spines very slender, the first two shorter than the others; pectorals reaching front of anal. Head $2\frac{3}{4}$; depth 5. D. IX–16; A. 13; V. I, 3; scales about 28 in a longitu-

* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 134: type *Scorpænichthys lateralis* Girard. Dedicated to Petrus Artedi, the "father of Ichthyology," the ablest student of fishes before Cuvier.

dinal series. L. 5 inches. Rock-pools; from Puget Sound to San Luis Obispo; not common.

(*Scorpænichthys lateralis* Grd. Proc. Acad. Nat. Sci. Phila. 1854, 145: *Artedius lateralis* Girard, U. S. Pac. R. R. Surv. Fish. 70: *Artedius lateralis* Günther, ii, 174.)

bb. Top of head uneven; interorbital area concave.

c. Head with stellate scales above.

1047. I. notospilotus (Grd.) J. & G.

Olivaceous, often tinged with purplish, and much variegated; a black bar at occiput; another from middle of spinous dorsal to the axil; one under front of second dorsal extending obliquely forwards; one under posterior part of second dorsal; one on caudal peduncle; bars and interspaces everywhere finely reticulated and mottled; lower parts dusky, with brassy tinge, often with dark reticulations around whitish spots; branchiostegals blackish, with yellow tinge; fins all variegated, the lower fins generally dusky; a black spot ocellated with orange between first and second dorsal spines, sometimes a duller one between third and fourth; a large black spot between sixth and eighth spines. Head short and broad, its vertex depressed; nuchal region with a cross-ridge, in front of which is a quadrate depression; two blunt tubercles behind each eye, armed at tip with small spines; behind these two others without spines, on the occipital ridges; each of these spines with a small cirrus; a small cirrus above posterior part of eye; a minute one on the maxillary; interorbital space deeply concave, the supraocular ridges elevated. Eye very large, $4\frac{2}{3}$ in head. Mouth moderate, broad, the maxillary extending to beyond the pupil, its length nearly half that of the head; suborbital stay strong; preopercle with a strong process, bifid at tip, and with one or more upward-directed spines; below this three blunt serrated processes or multifid spines; vertex, temporal region, interorbital space, and opercles covered with small, detached, stellate scales, strongly spinous at their edges; these smaller than the scales of the dorsal band. Head $2\frac{3}{4}$; depth $4\frac{3}{4}$. D. IX–15; A. 11 or 12. L. 10 inches. Northern specimens represent a marked variety, the color paler, the head more scaly, and the edge of the preopercle without serrated processes. D. IX–17; A. 12. Pacific coast; abundant at Santa Barbara and in Puget Sound; not found in rock-pools.

(*Calycilepidotus lateralis* Ayres, Proc. Cal. Acad. Sci. 1856, 77: *Artedius notospilotus* Grd. Proc. Acad. Nat. Sci. Phila. 1856, 134, and U. S. Pac. R. R. Surv. Fish. 71: *Artedius notospilotus* Günther, ii, 174.)

cc. Head without developed scales.

d. Upper preopercular spine hooked, bifurcate. (*Icelus.*)

1048. I. hamatus Kröyer.

Yellowish, with many brown spots. Head large, naked; upper preopercular spine small, hooked upwards, bifurcate; 3 spines below it, two of them hooked upwards; two blunt occipital spines; vertex depressed. Skin of body above with warty scales and small prickles; some rows of bony scales from neck to base of caudal; a series of tubercles along lateral line; sides of body with scattered scales; interocular space very narrow, its width 4 in eye; dorsals separated; pectorals shorter than head; no air-bladder; gill-membranes broadly joined, free from isthmus; no slit behind last gill. D. IX–20; A. 16; V. I, 3. Arctic Seas, Alaska to Spitzbergen.

(Kröyer, Naturhist. Tidsskr. i, 253, 1844; Günther, ii, 172.)

dd. Upper preopercular spine long, with 5 hooked processes.

1049. I. quadriseriatus (Lockington) J. & G.

Pale olivaceous, somewhat mottled; lateral line with dark blotches; branchiostegal region black in the males; a black bar at base of caudal; a black spot at front of spinous dorsal, and one at tip of the last spine; pectorals with a dark spot at base; other fins olivaceous, little variegated. Body slender, little compressed, tapering from the shoulders to the slender tail. Mouth moderate, the maxillaries reaching about to middle of pupil; a pair of ridges on the occiput, each ending in a spine, the space between them concave; interocular space very narrow, grooved; upper preopercular spine very long, armed with about 5 hooks, all but one directed upwards; below this three simple spines. Head naked or very nearly so, with conspicuous mucous pores above and a few minute cirri. Dorsal fins separated; pectorals broad, about reaching anal; ventrals very small. Lateral line with a series of spinous plates; above it along the back a double series of spinous plates placed at an angle, the upper plates with the free edge downward and backward, the lower plates with the free edge upward and backward; this band composed of a single series before and behind, and not extending around the dorsal in front; skin otherwise perfectly smooth. Head $3\frac{1}{3}$; depth $5\frac{1}{2}$. D. VIII–13; A. 12; V. I, 3. L. 3 inches. Deep waters off San Francisco; locally very abundant.

(*Artedius quadriseriatus* Lockington, Proc. U. S. Nat. Mus. 1879, 330.)

aa. Spinous dorsal fin deeply emarginate; head scaly. (*Chitonotus** Lockington.)

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*Lockington, Proc. U. S. Nat. Mus. 1881, 141: type *Chitonotus megacephalus* Lock. (χιτών, a rough cloak; νῶτος, back.)

1050. I. megacephalus (Lock.) J. & G.

Color pale olivaceous with darker cross-bars; fins in the male, blackish; ventrals and anal whitish, unmarked; eye dusky above. Body fusiform; head long; eyes large, separated by a very narrow, slightly concave interorbital space; mouth large, the maxillary extending to posterior border of eye; preopercle with a strong process armed with 3 or 4 upward-directed and 1 horizontal point; below this 3 other spines; two or three spines close behind eye on each side; two occipital ridges, ending in spines, the space between them concave; top of head, interocular space, snout, upper part of opercle, and a narrow belt close under the eye covered with rough scales; lateral line with a series of quadrate plates, their upper and posterior edges strongly serrate, the lower and anterior edges imbedded; above these the back is evenly covered with smaller scales, the lower and anterior part of each scale imbedded, and the upper edge strongly toothed; 5 to 8 rows of these scales; a narrow naked area at base of dorsal. Dorsal spines slender, the first usually longer than head, reaching past front of soft dorsal when depressed; the second and third spines progressively shortened; the 4th higher than third, the membrane between third and fourth deeply emarginate; second dorsal high; pectorals reaching past front of anal; ventrals to vent; anal papilla very large; no conspicuous cirri. Head $2\frac{3}{4}$; depth $5\frac{1}{4}$. D. III, VII–15; A. 15; V. I, 3; Lat. l. 38. L. 6 inches. Off San Francisco, in deep water, locally abundant; possibly a variety of the next.

(*Chitonotus megacephalus* Lockington, Proc. U. S. Nat. Mus. 1881, 141.)

1051. I. pugettensis (Steind.) J. & G.

Coloration of the preceding. Body slender, stouter than in *I. megacephalus;* head shorter and broader; the mouth also shorter, the maxillary not reaching posterior margin of eye; interorbital space extremely narrow, narrower than in *I. megacephalus;* squamation and armature of head and body precisely as in *I. megacephalus.* Dorsal lower than in *I. megacephalus*, the first dorsal less deeply notched; the first spine little higher than the second, its tip not reaching to the end of the fin, its total length less than half that of the head; soft dorsal high, higher than first dorsal spine. Head 3; depth $4\frac{2}{3}$. D. III, VII–15; A. 15; V. I, 3; Lat l. 37. L. 6 inches. Puget Sound.

(*Artedius pugettensis* Steindachner, Ichth. Beiträge, v, 133.)

** Skin naked, smooth.

1052. I. *uncinatus (Reinh.) Kröyer.

Olivaceous, mottled and barred with darker, above and on fins. Head broad; lower jaw included; palatine teeth well developed; maxillary extending to opposite middle of pupil. Eyes very large, separated by a narrow ridge; occiput with two blunt ridges, in front of which the vertex is concave; upper preopercular spine large, strongly hooked upward, more than half length of eye; downward-directed spine on preopercle long and sharp; skin perfectly smooth. Pectorals reaching front of anal; spinous dorsal rather high; vent midway between snout and middle of caudal. Head 3; depth 4½. D. VIII–13; A. 11. L. 4 inches. Cape Cod to Greenland, in deep water; abundant.

(*Cottus uncinatus* Reinh. Vid. Selsk. Natur. og Math. Afhandl. 1833, 44: *Centridermichthys uncinatus* Günther, ii, 172: *Icelus uncinatus* Kröyer, Naturh. Tidsskr. 1844, 253.)

1053. I. (?) **bicornis** (Reinh.) J. & G.

Occiput with two acute points; four preopercular spines, the uppermost of which is bifurcate. Skin not described. D. VIII–15; A. 14. Greenland. (*Günther.*)

(*Cottus bicornis* Reinh. Vidensk. Selsk. Natur. og Math. Afh. viii, lxxxv: *Centridermichthys bicornis* Günther, ii, 172.)

366.—URANIDEA Dekay.

Miller's Thumbs.

(*Cottus* and *Cottopsis* Girard.)

(Dekay, New York Fauna, Fish., 1842, 61: type *Uranidea quiescens* Dekay = *Cottus gracilis* Heckel.)

Fresh-water sculpins. Body fusiform. Head feebly armed, the preopercular spines covered by the skin; skin smooth or very nearly so; villiform teeth on jaws and vomer, none on palatines. Gill-openings separated by a wide isthmus, over which the membranes do not form a fold; no slit behind fourth gill. Branchiostegals 6. Dorsals nearly or quite separate, the first of 6–9 slender spines; ventrals I, 3, or I, 4. Fishes of small size, inhabiting clear waters in the northern parts of Europe, Asia, and America. The species are extremely nu-

* This species should form the type of a distinct genus if the current genera of this group are to be recognized. The Japanese genus *Centridermichthys* Rich. to which this species and many others of our Cottoids have been referred, differs from *I. uncinatus* in having the slit behind the last gill developed, and the gill-membranes fully united to the isthmus.

merous, and are very difficult to distinguish, all being very similar in form and coloration. The relations of this genus to *Cottus* are very close. (*ὁυρανὸς*, the sky; *ειδω*, to look.)

a. Palatines with teeth; ventrals I, 4 (except in 1059).

b. Preopercular spine large, strongly hooked; skin above with coarse prickles. (*Tauridea** Jordan & Rice.)

1054. U. spilota Cope.

Olivaceous, finely speckled and mottled with darker; belly white; fins mottled. Body contracted at front of anal, subterete posteriorly. Head very broad and flat; no occipital prominences; preopercular spine extremely large, as long as eye, hooked upward; below it are three small spines directed downwards; subopercular spine strong; space above lateral line behind head, covered with small stiff prickles, coarser than in *U. aspera* and farther apart, slightly hooked backward; no spines behind axil; isthmus broad, the gill-membranes fully joined to it, not forming a fold. Head $3\frac{3}{5}$; depth $5\frac{1}{3}$. D. VIII–17; A. 12. Great Lakes, in deep water, and northward to Hudson's Bay.

(*Uranidea spilota* Cope, Proc. Acad. Nat. Sci. Phila. 1865, 82: *Cottopsis ricei* Nelson, Bull. Ills. Mus. Nat. Hist. 1876: *Tauridea spilota* Jordan, Man. Vert. E. U. S. 255: *Cottopsis spilotus* Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 81; Bean, Proc. U. S. Nat. Mus. 1881, 127; specimens from near Hudson's Bay, said to have no palatine teeth.)

bb. Preopercular spine small, more or less perfectly concealed in the skin.

c. Skin almost everywhere villous. (*Cottopsis*† Girard.)

1055. U. aspera (Rich.) J. & G.

Grayish olive, much mottled and barred; fins finely variegated; usually a large black blotch on posterior part of spinous dorsal. Body rather stout, compressed behind. Head rather broad, transversely convex; opercle and preopercle with the usual spines, all small and nearly concealed in the skin; interorbital space broad and flattish, broader than eye (in adults); skin covered with small close-set prickles, forming a villous covering, the prickles smaller, stiffer, and more closely set than in the next species; head, belly, caudal peduncle, and space along dorsal smooth, or nearly so; pectorals reaching anal; ventrals, I, 4, nearly reaching vent; dorsal spine slender; lateral line complete, angularly bent below last rays of second dorsal. Head 3; depth $4\frac{1}{4}$. D. X–21; A. 18. L. 10 inches. Streams west of the Sierra Nevada

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*Jordan & Rice, Man. Vert. E. U. S. ed. 2, 1878, 255: type *Cottopsis ricei* Nelson. (*ταυρα*, cow; *ειδεα*, appearance.)

†Girard, Proc. Bost. Soc. Nat. Hist. iii, 303, 1850: type *Cottus asper* Rich. (*κοττος*, Cottus; *ὀψίς*, appearance.)

and Cascade Mountains; abundant; specimens from the Sacramento River (var. *parvus*) smaller in size, paler in color and with the interorbital space concave, narrower than eye.

(*Cottus asper* Rich. Fauna Bor.-Amer. Fish. 295, 1836: *Trachidermus richardsoni;* Heckel, Ann. Wiener Mus. 1840, 162: *Centridermichthys asper* Günther, ii, 170: *Cottopsis asper* Grd. U. S. Pac. R. R. Surv. Fish. 51: *Cottopsis parvus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 144: *Centridermichthys parvus* Günther, ii, 170.)

1056. U. semiscabra (Cope) J. & G.

Olivaceous, barred and spotted as in other species; fins mottled; spinous dorsal pale at base and tip, with a median broad black band; two dark blotches at base of caudal. Form of *U. aspera*, but slenderer. Skin* of top of head and entire body, except lower part of caudal peduncle, thickly covered with papillæ; those of anterior and upper parts of body each tipped with a spine, many of those on head with median pores; top of head with a median lengthwise depression. Head narrowed anteriorly, the maxillary extending to beyond pupil; opercular and preopercular spines as in *U. aspera;* lateral line not complete; spinous dorsal low; soft dorsal and anal high; caudal long; pectorals about reaching anal; ventrals rather broad, reaching half way to anal. Eye $4\frac{1}{2}$ in head. Head $3\frac{1}{3}$; depth $4\frac{1}{4}$. D. VII–18; A. 14; V. I, 4. L. 4 inches. Fort Hall, Idaho (*Cope*). Utah Lake (*Jordan*).

(*Cottopsis semiscaber* Cope, Hayden's Survey, Montana, for 1871–'72, 476: *Cottopsis semiscaber* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 459.)

cc. Skin smooth, or prickly in or behind the axil only. (*Potamocottus*† Gill.)

1057. U. gulosa (Grd.) J. & G.

Olivaceous, variously mottled and barred; fins clouded with darker. Form rather robust. Mouth moderate, the maxillary reaching to pupil; palatine teeth evident. Eyes small, little wider than the interorbital space; preopercular spine short; spinous dorsal low; pectoral fins about reaching anal; ventrals I, 4, not to vent. Head 3; depth 5. D. IX–21; A. 15–17 (Washington); D. VIII–20; A. 18 (California). L. 6 inches. Rivers from California to British Columbia; not rare. California examples have the axillary prickles developed as usual in *U. richardsoni;* all of them within the space covered by pectorals when depressed. Specimens from Vancouver's Island and about Port Townsend have these prickles forming a considerable band, and extending

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* "Skin prickly above the lateral line; smooth below it posteriorly." (*Cope.*)

†Gill, Proc. Bost. Soc. Nat. Hist. viii, 40, 1861: type *Cottus punctulatus* Gill. (ποταμος, river; κοττος, sculpin.)

backward on both sides of the lateral line to the middle of the second dorsal, the band narrower and the prickles smaller posteriorly.

(*Cottopsis gulosus* Grd. Proc. Acad. Nat. Sci. Phila. 1854, 129: *Centridermichthys gulosus* Günther, ii, 170.)

1058. U. punctulata (Gill) Cope.

Light olivaceous; body covered with small black spots, which become larger and more scattered behind; soft dorsal, pectorals, and caudal thickly spotted; spinous dorsal without dark blotch. Head long and wide. Mouth quite large; maxillary reaching past front of orbit; preopercular spine strong, directed obliquely backward and upward. Head 3; depth 5. D. VIII–17; A. 13. (*Gill.*) Bridger's Pass; distinguished from the other species by the speckled coloration.

(*Potamocottus punctulatus* Gill, Proc. Bost. Soc. Nat. Hist. 1861, 40, and in Ichth. Capt. Simp. Expl. 1876, 402.)

1059. U. bendirei (Bean) J. & G.

Uniform dark brown above, lighter below. Maxillary extending just beyond front of eye; eye 4 in head; preopercle with 4 spines, the upper one half as long as the eye. Pectorals reaching origin of anal; ventrals not to vent. Depth 4. D. VIII–16; A. 12; V. I, 3. Walla-Walla, Wash. (*Bean.*)

(*Potamocottus bendirei* Bean, Proc. U. S. Nat. Mus. 1881, 27.)

1060. U. richardsoni (Agassiz) J. & G.—*Miller's Thumb; Blob; Muffle-jaw; Bull-head.*

Olivaceous, more or less barred and speckled with darker; fins mostly barred or mottled. Body slender or stout, tapering regularly backward to the tail; vertex somewhat depressed; interocular space with a groove; preopercle with a short sharp spine, little hooked, directed backwards and upwards, mostly covered by the skin; below this are 2 smaller concealed spines; subopercle with a stoutish spine, directed forwards. Skin smooth, except the region immediately behind the pectorals, which is beset with very small sharp prickles which are sometimes obsolete; lateral line conspicuous, continuous or interrupted behind; first dorsal low and feeble; pectoral fins large, their length nearly equal to that of the head, their tips usually reaching beyond the origin of the soft dorsal; ventral fins moderate; isthmus very broad, the gill-membranes not forming a fold across it. Head $3\frac{1}{3}$; depth 4–6. D. VI to VIII–16 or 17; A. about 12; V. I, 4. L. 3–7 inches. Middle and Northern States, abounding in all clear rocky brooks and lakes; extending southward along the Alleghanies to Alabama.

NOTE.—As here understood, a wide-spread and abundant species, varying in different regions, as is the case with most non-migratory species. In this as in others of similar range, the inhabitants of each stream may show local peculiarities. A number of these forms have received from Dr. Girard specific names, which are accompanied by detailed descriptions. Large collections of these fishes show that numerous similar "species" still exist undescribed, as it is a rare thing to find a specimen which exactly agrees in all respects with any of the species in Dr. Girard's "Monograph of the Fresh-Water Cottoids." The following forms, of all of which the writers have specimens, may possibly be recognized as "varieties," but of their complete intergradation we have no doubt:

Var. *richardsoni* (Ag.) is rather slender, with the vent rather more posterior than usual, placed midway between the snout and the tip of the caudal; in the others it is nearly midway between the snout and the middle of the caudal. Wisconsin to Lake Superior.

(*Cottus richardsoni* Agassiz, Lake Superior, 1850, 300: *Cottus richardsoni* Girard, Monograph Fresh-Water Cottoids N. A. 39: *Cottus richardsoni* Günther, ii, 158)

Var. *bairdi* (Girard) is small and slender, with the spinous dorsal very low, and the palatine teeth less developed than in the other forms. Cayuga Lake, N. Y., to Ohio.

(*Cottus bairdii* Girard, Proc. Amer. Assoc. Adv. Sci. ii, 1850, 410, and Mon. Cott. 44.)

Var. *wilsoni* (Grd.) is rather stouter, with stronger palatine teeth, and with some of the uppermost of the pectoral rays bifurcate, these being entire in the others. Ohio Valley, Pennsylvania, and Indiana.

(*Cottus wilsoni* Grd. l. c. 42.)

Var. *alvordi* Grd. is short and chubby, with the first dorsal rather high, and joined by membrane to the second more than in other forms. Common in Wisconsin and Michigan.

(*Cottus alvordi* Grd. l. c. 46.)

Var. *meridionalis* (Grd.) is rather robust, with the dorsal fins scarcely connected, and the mouth rather larger, the maxillary extending to opposite posterior border of eye; the preopercular spine is sharp and directed well upward. Pennsylvania to North Carolina, along the Alleghanies; abundant.

(*Cottus meridionalis* Girard, Proc. Amer. Assoc. Adv. Sci. ii, 1850, 410, and l. c. 47.)

Var. *zophera* (Jor.) is slender and very dark in color, and more conspicuously variegated; the first dorsal high; the palatine teeth well developed. Alabama River.

(*Potamocottus zopherus* Jordan, Ann. Lyc. Nat. Hist. N. Y. 1876, 320.)

Var. *carolinæ* (Gill) is a very large form, rather robust, reaching a length of nearly six inches, without axillary prickles, and with the palatine teeth well developed. The lateral line, as in the other forms, is sometimes continuous and sometimes interrupted. It abounds in the limestone region from Indiana to Tennessee, and is frequently found in caves.

(*Potamocottus carolinæ* Gill, Proc. Bost. Soc. Nat. Hist. 1861, 40: *Potamocottus carolinæ* Gill, Simps. Rept. Ichth. Utah, 1877, 403.)

1061. U. wheeleri Cope.

Body slender, entirely smooth. Head not broad; maxillary reaching pupil. Lateral line deflexed below dorsal. Eye large, 5 in head; isthmus as wide as distance from pupil to snout; preopercular spine strong. Pectoral longer than head, reaching past front of anal, longer than usual in *U. richardsoni*. Head 3; depth $6\frac{3}{4}$. D. VII–17; A. 12; P. 15,

its rays all simple. Utah and Western Colorado, abundant; not evidently different from the preceding.

(*Uranidea wheeleri* Cope, Proc. Amer. Phil. Soc. Phila. 1874, 138: *Uranidea wheeleri* Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer. v, 696.)

aa. Palatine teeth obsolete. (*Uranidea.*)
c. Ventral rays I, 4.

1062. U. cognata (Rich.) J. & G.

Apparently similar to the European *Uranidea gobio*, and distinguished from most of the American species by having the ventral rays 1, 4. Skin smooth; pectorals as long as head; preopercular spine small curved upwards. D. VIII–18; A. 14. Great Bear Lake (*Richardson*); perhaps the same as the next.

(*Cottus cognatus* Richardson, Fauna Bor.-Amer. iii, 1836, 40: *Cottus cognatus* Girard, l. c. 41, and Günther, ii, 157.)

1063. U. minuta (Pallas) J. & G.

Olivaceous, finely variegated and speckled; fins above speckled. Body long and low, little compressed. Head rather small, wider than deep. Mouth short, comparatively small, the maxillary extending little beyond front of orbit; mandible included; preopercular spine sharp, straight. First dorsal low, the spines nearly even; pectorals reaching about to vent; ventrals not to vent; skin entirely smooth. Head 4; depth 4½. D. VIII–19; A. 14; V. I, 4; Lat. l. 36. L. 5 inches. Aleutian Islands. Perhaps a variety of the European *U. gobio.*

(*Cottus minutus* Pallas, Zoogr. Rosso.-Asiat. iii, 145, 1811–1831: *Uranidea microstoma* Lockington, Proc. U. S. Nat. Mus. 1880, 58: not *Cottus microstomus* Heckel.)

cc Ventral rays I, 3.
d. Anal rays 14 or 15.

1064. U. marginata Bean.

Olivaceous, blotched, the fins punctulate; first dorsal dark, with a distinct pale margin. Body stoutish. Head broad, slightly depressed; maxillary reaching to anterior third of orbit; preopercular spine short, bluntish; below this one or two smaller ones; vent nearer base of caudal than snout. Head 3; pectoral 4 in length; ventrals 6. D. VII or VIII–18 or 19; A. 15; V. I, 3. Walla Walla, Washington. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. 1881, 26.)

1065. U. viscosa (Hald.) Jor.

Olivaceous, variegated, the spinous dorsal edged with orange in life; fins mostly barred. Body rather stout; mucous pores on head unusually numerous. Mouth small; maxillary reaching middle of eye; pre-

ocular spine acute, extremely short, directed obliquely upwards; isthmus rather narrow; first dorsal low, slightly connected with second; pectorals shorter than head, reaching second dorsal. Head $3\frac{1}{2}$ in length; depth $4\frac{3}{4}$. D. VI–18; A. 14; V. I, 3. Pennsylvania and Maryland.

(*Cottus viscosus* Haldeman, Suppl. Monogr. Limnea 1842, 3: *Cottus viscosus* Girard, l. c. 51.)

dd. Anal rays 11 or 12.

1066. U. gracilis (Heckel) Putn.

Olivaceous, mottled, upper edge of spinous dorsal red in life. Body rather slender, fusiform; preocular spine moderate, concealed. Mouth rather large, the maxillary reaching nearly to the pupil; pectorals reaching front of anal; ventrals about to vent. Head $3\frac{1}{2}$; depth 5. D. VIII–16; A. 12. Streams of New England and New York; not rare.

(*Cottus gracilis* Heckel, Ann. Wien Mus. ii, 148, 1837: *Cottus gracilis* Girard, l. c. 49: *Cottus gobio* Ayres, Bost. Journ. Nat. Hist. v, 121, 1845: *Uranidea quiescens* De K. New York Fauna, Fish. 1842, 61.)

1067. U. gobioides (Girard) Jor.

Similar to the preceding, but larger and more robust, the mouth larger, reaching to beyond the line of the pupil, and the pectorals short, not quite reaching anal; preopercular spine stout, curved suddenly upwards. Head $3\frac{1}{2}$; depth $4\frac{3}{4}$. D. VII–17; A. 12. L. 4 inches. Tributaries of Lake Champlain. (*Girard.*) Probably a variety of *U. gracilis.*

(*Cottus gobioides* Girard, Proc. Amer. Assoc. Adv. Sci. 1850, 41, and l. c. 55.)

1068. U. boleoides (Girard) Jor.

Slender, sub-fusiform. Mouth rather large, the maxillary extending to opposite the pupil; preopercular spine acute, directed obliquely upwards; isthmus narrow. Fins larger than in any other species; pectorals reaching fourth ray of anal. Head $3\frac{1}{2}$; depth $5\frac{1}{2}$. D. VIII–17; A. 11. L. $3\frac{1}{4}$ inches. Connecticut Valley in Vermont. (*Girard.*)

(*Cottus boleoides* Girard, Proc. Amer. Assoc. Adv. Sci. 1850, 411, and l. c. 56: *Cottus boleoides* Günther, ii, 159.)

1069. U. franklini (Agass.) Jor.

Olivaceous, mottled; both dorsals and anal with a broad dark bar on the distal half; pectorals and caudal broadly blotched with dusky. Jaws equal; preopercular spine stout, short, pretty strongly hooked upwards and inwards; first dorsal rather high, not much lower than sec-

ond; pectorals short, not reaching anal; axil prickly, as in species of *Cottopsis*. Head 3½; depth 5. D. VIII–17; A. 11 or 12. Great Lakes, mostly in deep water.

(*Cottus franklini* Agassiz, Lake Superior, 1850, 303: *Cottus franklini* Girard, l. c. 53: *Cottus franklinii* Günther, ii, 158: ? *Cottus formosus* Girard, l. c. 58: *Uranidea kumlieni* Hoy, MSS.; Nelson, Bull. Ills. Mus. Nat. Hist. 1876, 41: *Uranidea kumlienii* Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 64.)

1070. U. hoyi Putnam.

Grayish olive, speckled and barred. Body rather slender. Female with the anterior parts of body and region above lateral line covered with sparse prickles; male apparently smooth. Head narrowed forwards; jaws narrow, about equal; maxillary reaching front of pupil; preopercular spine prominent, longer than pupil, sharp, almost straight, directed backwards and but little upwards; below this is another sharp, prominent spine, also nearly straight, directed partly downwards; 1 or 2 minute concealed spines still lower; pectoral fins reaching vent. D. VI–15; A. 11; V. I, 3. L. barely 2 inches. Lake Michigan, in deep water; the smallest species, well distinguished by its preopercular spine.

(Putnam MSS. Nelson, Bull. Ills. Mus. Nat. Hist. 1876, 41; Jordan, Proc. Acad. Nat. Sci. Phila. 1877, 63.)

367.—COTTUS* Linnæus.

(*Acanthocottus* Girard.)

(Artedi; Linnæus, Syst. Nat.: type *Cottus scorpius* L.)

Body rather slender, subfusiform, covered with thick skin, in which are sometimes imbedded prickly plates, especially along lateral line; deciduous granular tubercles also sometimes present, but no true scales. Head large. Mouth terminal, large, the lower jaw included; villiform teeth on the jaws and vomer, none on the palatines; suborbital stay strong; preopercle with 2 strong straight spines above directed backward, and 1 below directed downward and forward; opercle, nasal

* *Cottus mertensi* Cuv. & Val.

Yellowish, with dark marblings; spines of first dorsal rather strong; head smooth; point of preopercle not reaching opercle. D. VIII–15; A. 12; C. 10; P. 18. Kamtschatka. (*Cuv. & Val.*)

(Cuv. & Val. iv, 496, from a drawing.)

Cottus marmoratus Cuv. & Val.

Brownish, &c., much marbled; fins variegated; first dorsal with a large black spot; 2 strong spines before the eye; 2 short spines on the preopercle; a rather strong spine on opercle; dorsal spines rather strong. D. VIII–14; A. 12; C. 14. Kamtschatka. (*Cuv. & Val.*)

(Cuv. & Val. iv, 497, from a drawing.)

bones, orbital rim, and shoulder girdle usually armed; gill-membranes forming a fold across the rather narrow isthmus; slit behind last gill small or wanting, often reduced to a mere pore; vertebræ about 28. Branchiostegals mostly 6. Dorsal fins 2, separate, the first short, its spines rather slender; ventral rays usually I, 3. Species numerous in the seas of northern regions. (*κόττος*, the ancient name of *Uranidea gobio*, from *κόττος*, head.)

a. Head with small tentacles; lateral line with distinct plates.

1071. C. bubalis Euphrasen.—*Father-lasher.*

Colors variegated, the dark markings sometimes red. Head broad, depressed, covered with soft skin, in which are many mucous pores; maxillary reaching past middle of orbit; upper preopercular spine straight, slightly longer than eye; opercular spine granulated at base; small cirri above eye and elsewhere on head; usually one on end of maxillary; cranial bones mostly covered by skin; lateral line with some bony plates, which are most distinct anteriorly; these are very much smaller than in *Enophrys bison;* interocular space very narrow, its ridges continuing backward, serrated, each ending in a sharp spine; no trace of slit behind last gill; spinous dorsal low; anal small; pectorals reaching front of anal; ventrals moderate. Head $2\frac{2}{3}$; depth $3\frac{2}{3}$. D. VIII–12; A. 9; Vertebræ 12 + 17. Arctic Europe; said to stray to Greenland.

(Enphrasen, Nya Schwed. Abhandl. 1786, 64; Günther, ii, 164; Day, Fish. Gt. Brit. Ireland, 1880, 51.)

aa. Head without tentacles; lateral line unarmed or with concealed plates.

1072. C. octodecimspinosus Mitch.

Olivaceous, with transverse dark bars, paler below; fins barred and mottled; ventrals plain. Body very slender, tapering backward to the long and slender caudal peduncle. Head long and narrow; mouth moderate; maxillary not extending past eye, $2\frac{1}{4}$ in head. Upper preopercular spine extremely long, longer than eye, extending beyond tip of opercular spine, its length more than 4 times that of the spine below it; a strong spine at upper posterior margin of orbit directed upward and backward; occipital ridges long, low, converging behind, each ending in a similar spine. Vertex nearly flat. Eye very large, as long as snout, $4\frac{1}{2}$ in head, much wider than interorbital space; nasal spines sharp. Skin usually without rough tubercles; lateral line with a series of partly concealed plates. Spinous dorsal higher than soft dorsal; the spines strong, the longest nearly half head; pectorals reaching

anal; ventrals not to vent; no trace of slit behind last gill. Head $2\frac{1}{2}$; depth $5\frac{1}{2}$. D. IX–15; A. 14; V. I, 3. Atlantic coast; rather common northward.

(Mitch. Trans. Lit. and Phil. Soc. N. Y. i, 380, 1815; Günther, ii, 163: *Acanthocottus virginianus* Storer, Hist. Fish. Mass. 28.)

1073. C. æneus Mitchill.—*Grubby.*

Grayish olive, much variegated with darker; no distinct paler spots; back and sides with broad, dark, irregular bars; all the fins barred; mandible mottled; belly pale. Head rather broad; maxillary $2\frac{1}{3}$ in head, reaching to just beyond pupil; supraocular and occipital ridges prominent, each with a low, bluntish spine; nasal spines moderate; upper preopercular spine shorter than eye, nearly twice length of the next spine, about reaching middle of opercle. Lateral line complete; sides with scattered concealed plates. Dorsal spines rather low, higher than the soft rays; pectorals reaching anal; no trace of slit behind last gill. Head $2\frac{3}{4}$; depth 4. D. IX–13; A. 10; V. I, 3. L. 6 inches. Coast of Southern New England and New York; our smallest species; common in seaweeds near shore.

(Mitchill, Trans. Lit. and Phil. Soc. N. Y. i, 1815, 380; Goode & Bean, Bull. Essex Inst. 1879, 13: *Cottus mitchilli* Günther, ii, 164.)

1074. C. scorpioides Fabricius.

Very dark, finely mottled with paler; fins dusky, with paler spots; anal and ventral fins with the pale spots larger. Body stoutish, tail slender. Head very short; jaws short, the maxillary reaching the middle of the large eye; top of head concave between the two occipital ridges; preopercular spines quite short; opercular spine almost obsolete. Skin nearly smooth. Isthmus narrow, the fold across it very narrow; no trace of slit or pore behind the last gill. Dorsal fins slightly joined, the spines slender; pectorals reaching vent. Head 3; depth $4\frac{2}{3}$. D. X–17; A. 12; V. I, 3. Arctic regions of America; Greenland to Siberia.

(Fabr. Fauna Groenl. 157, 1780; Bean, Bull. U. S. Nat. Mus. xv, 122; Lütken Aft. Vidensk. Meddels. Kjöbenh. 1876, 12: *Cottus pachypus* Günther, ii, 161.)

1075. C. scorpius L.

Dark olivaceous, mottled with paler; fins dusky, with paler spots. General characters of the subspecies *grœnlandicus*, from which it differs chiefly in the smaller size, the narrower interorbital space, which is $\frac{5}{7}$ diameter of eye, and in the lower spinous dorsal, the highest spines being about one-eighth the length to base of caudal; pore behind last gill usually very small, but evident. Head $2\frac{1}{2}$; depth $4\frac{1}{4}$. D. X–16; A. 14. Northern Europe and Arctic regions of America, south to Eastport, Me.

(L. Syst. Nat.; Günther, ii, 159; Bean, Bull. U. S. Nat. Mus. xv, 116.)

Subsp. **grœnlandicus** (Cuv. & Val.) Bean.—*Daddy Sculpin.*

Dark brown above, with broad darker bars; below yellowish, the belly in the male with large pale spots; back and top of head with grayish blotches; fins brown and yellow, all of them spotted and barred. Head large. Mouth large; maxillary reaching posterior edge of orbit, $2\frac{1}{3}$ in head; the supraorbital and occipital spines tubercle-like; a small tubercular spine on front of occipital ridge; upper preopercular spine reaching middle of opercular spine, its length equal to eye, not twice that of the spine below it; nasal spines sharp. Sides of body above lateral line with a series of imbedded prickly plates, below which are numerous scattered spines and prickles. Dorsal and anal fins high; spinous and soft dorsals about equal in height, their height more than one-seventh of length of body; ventrals long; pectorals about reaching vent. Eye large, equal to least interorbital width (in specimens a foot long). Head $2\frac{1}{2}$; depth $4\frac{1}{2}$. D. X–17; A. 14; V. I, 3; P. 18. L. 25 inches. New York to Greenland, common; one of the largest sculpins.

(*Cottus grœnlandicus* Cuv. & Val. iv, 156: *Acanthocottus variabilis* Girard, Bost. Journ. Nat. Hist. vi, 248: *Cottus grœnlandicus* Günther, ii, 161; Goode & Bean, Bull. Essex Inst. xi, 13, 1879: *Acanthocottus variabilis* Storer, Hist. Fish. Mass. 26; Day, Fish. Gt. Brit. 1880, 51: ? *Cottus porosus* C. & V. viii, 498: *Acanthocottus mucosus* Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 12.)

1076. C. polyacanthocephalus Pallas.

Dark olive above, much variegated with darker and reddish; belly mostly whitish; sides and belly (in males) with numerous blackish reticulations surrounding large round white spots; jaws dusky, mottled with whitish; membrane joining maxillary to preorbital black, with round white spots; fins, all but the ventrals, mottled and barred with blackish and yellowish. Body rather elongate. Head long and narrow, somewhat compressed, concave between the orbits, the orbital rim being elevated; nasal spines strong; a strong ridge above eye, with a blunt compressed spine behind it; behind this a small digitate cluster of ridges ending in low spines; behind these an irregular broken ridge on each side of the vertex, extending to the occiput; outside of this another ragged ridge; suborbital stay strong, striate; upper preopercular spine long, straight, simple, striate at base, longer than eye; a similar but shorter spine below it, not half as long, and the usual downward-directed spine at lower edge of preopercle and subopercle; opercular spine moderate. Mouth rather large, the maxillary reaching beyond eye, half length of head; skin of top of head covered with small smooth warts; skin of body with some scattered rough tuber-

cles, usually nearly smooth. Dorsals not very high; dorsal spines slender; pectorals reaching anal; ventrals moderate, I, 3. A minute pore usually present behind last gill. Lateral line complete. Head $2\frac{1}{4}$; depth $4\frac{1}{4}$. D. X–I, 13; A. 11. L. 24 inches. Puget Sound to Alaska; very abundant; one of the largest sculpins.

(Pallas, Zoogr. Ross.-Asiat. 1811, iii, 133; Günther, ii, 166.)

1077. C. labradoricus (Grd.) Gthr.

Nasal spines small; a rough prominence above orbit, and two similar ones on occiput; a slight depression on crown; four preopercular spines, the upper about $\frac{2}{3}$ length of eye, equal to interorbital width; eye as long as snout, 5 in head, half length of maxillary, which extends to the vertical from its hinder margin. Dorsal spines slender, the longest $\frac{5}{6}$ length of maxillary; pectorals reaching a little beyond anal; ventrals not to vent; skin above lateral line with a few spinous tubercles; a small slit behind fourth gill. D. X–14; A. 14; V. I, 3; P. 17; C. 11; B. 6. (*Bean.*) Labrador and Hudson's Bay.

(*Acanthocottus labradoricus* Grd. Bost. Journ. Nat. Hist. vi, 1850, 247, pl.; Günther, ii, 163; Bean, Proc. U. S. Nat. Mus. iv, 1881, 128.)

1078. C. taeniopterus* Kner.

Color of *C. grœnlandicus*, but darker, with dark bars; gill-membranes and hinder part of belly dark; dark regions, with very bright white specks of different sizes; first dorsal partly black, partly transparent; second dorsal crossed by 3 oblique dark bands; anal by 4, in contrary directions; caudal with 3 dark bars; pectoral with 4 or 5 dark bars, much narrower than the interspaces; ventrals with black and white spots. Lower jaw projecting. Eye 5 in head, as long as snout; supraocular ridge slightly elevated, continued backward as a low bony ridge, without spines; a quadrangular depression between these ridges; crown and occiput with naked warty skin; preopercle with 4 spines, the uppermost straight, as long as eye; highest dorsal spine half length of head; soft dorsal twice as high; pectorals reaching anal; ventrals to vent. Sides often with irregular rough bony tubercles; a moderate slit behind last gill; gill-membranes partly free from isthmus. D. VIII–13; A. 12; Lat. l. 40. (*Kner.*) Alaska to Northern China..

(*Cottus tæniopterus* Kner. Sitzungsber. Kais. Acad. Wiss. Wien, 1868, 310; Bean, Proc. U. S. Nat. Mus. 1881, 248.)

1079. C. quadricornis* L.

Olivaceous, somewhat variegated; the fins faintly spotted. Body

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* *Oncocottus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 13: type *Cottus quadricornis* Gill. (*ογκος*, hook; *κόττος*, Cottus.)

rather slender. Head long, tapering forward; mouth large, the maxillary reaching to below posterior margin of eye; eye moderate, 4 in head; bones of head below eye cavernous, as in *Triglopsis thompsoni*, but less so; preopercle with 2 long, diverging spines, the upper and longer not quite reaching opercular margin; opercular and scapular spines quite short; a rugose spine, sometimes broader and expanded at tip like a cock's comb, above each eye posteriorly, and a similar one on each side of occiput. Males with irregular series of round, rough, wart-like scales above the lateral line; these wanting in the female; lateral line chain-like, with small imbedded plates; head naked. Frst dorsal convex, of slender spines, well separated from second, which is rather high, the longest ray $1\frac{2}{3}$ in head; pectorals reaching anal; ventrals moderate. A moderate slit behind last gill. D. VIII–14; A. 13; cœca 7; vert. 40; Lat. l. 45. Greenland to the Baltic Sea.

(*Cottus quadricornis* L. Syst. Nat.: *Cottus quadricornis* Günther, ii,.166: *Oncocottus quadricornis* Gill: *Cottus hexacornis* Rich. Franklin's Journ. 726: *Cottus hexacornis* Günther, ii, 166; Day, Fish. Gt. Brit. 1880, 53.)

1080. C. humilis Bean.

Brownish, pale below; sides with a few white blotches; first dorsal with 2 broad oblique dark bands, separated by a pale area; second dorsal with 5 dark bands; anal with 6; pectorals with 4; caudal with 3; ventrals pale, with 2 dark areas. Head broad, subtriangular, much depressed, its greatest depth $2\frac{2}{3}$ in its length; eye 2 in snout, 7 in head, equal to the concave interorbital space; surface of head covered with small dermal tubercles; patch of vomerine teeth very large; nasal spines strong; a blunt prominence above each eye, and 2 on the occiput; several radiating ridges behind eye, as in *C. polyacanthocephalus;* upper preopercular spine as long as eye; maxillary reaching slightly past eye, $2\frac{1}{3}$ in head. Longest dorsal spine about half postorbital part of head; pectorals reaching soft dorsal. A series of rough bony tubercles above lateral line and some small ones below it. A pore behind last gill. Head $2\frac{2}{3}$; depth $5\frac{1}{2}$. D. X–16; A. 13; V. I, 3; P. 18; B. 6. Chamisso Island, near Bering's Straits. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. iv, 149, 1881.)

1081. C. jaok Cuv. & Val.

Body and pectoral fins spotted with brown; vertical fins with brown bands. Resembles *C. scorpius;* the preopercular spines similar, but there are slight granulations instead of tubercles behind the eye and

temples; rough scale-like tubercles along the back above the lateral line; first dorsal low. D. VII–15; A. 15. L. 21 inches. Bering's Sea. (*Cuv. & Val.*)

(*Myoxocephalus* Steller MSS. in Tiles. Mém. Acad. Sci. Petersb. iv, 273, 1811 (*non-binomial*); Cuv. & Val. iv, 172; Günther, ii, 165.)

1082. C. axillaris (Gill) Bean.

Bluish, with whitish spots on trunk and a darker band-like spot below anterior portion of second dorsal; abdomen yellowish; region above anal spotted; above this are larger spots confluent with the dark color of sides; spinous dorsal with 2 vertical dark bands; second dorsal with 3 oblique ones; caudal banded; anal spotted; pectoral black at base, with 2 oblique bands; a dark spot on lower axil. Head subrhomboidal, large, depressed; postorbital crests little developed; preopercle with 2 simple spines near the angle, and 2 tubercles below; opercle with a longitudinal rib ending in a spine. Skin smooth, or with scattered tubercles. Gill-membranes forming a fold across the isthmus. D. IX–15; V. I, 3; B. 6. Bering's Strait. (*Gill.*)

(*Boreocottus axillaris* Gill, Proc. U. S. Nat. Mus. 1859, 166.)

1083. C. (?) **polaris** Sabine.

Pale, with clusters of minute dark spots. Head compressed; nasal spines present; lower jaw included; preopercle with 4 strong spines; pectoral fins larger than in *Uranidea gobio;* lateral line with a series of small tubercles. D. VI to VIII–13; P. 15; V. I, 4; A. 14; C. 14. L. 2 inches. North Georgia, British America. (*Storer.*) Probably not a *Cottus*.

(Sabine, Parry's First Voyage, 213; Storer, Synop. Fish. N. A. 307.)

1084. C. (?) **platycephalus** Pallas.

Olivaceous, much variegated, white below; fins spotted. Head large, much depressed, as broad as the body; lower jaw projecting; teeth on vomer and on palatines (?) ("in area lunata palatio medii, et utrinque lineari"). Eyes moderate, near together; vertex flat behind the eyes, with a ridge on each side, in front of which near the orbit, and behind at the nape, are oblong tubercles, each ending in a short spine; preopercle with 2 very strong, diverging spines above; opercle with a concealed spine; lateral line with concealed, elongate plates; back with rough warts; pectorals large; dorsal spines feeble. D. VII–12; A. 11; C. 10; P. 15; V. I, 3. L. 12 inches. Kamtschatka. (*Pallas.*) If this

species really has palatine teeth, it cannot belong to this genus. It may be a speciês of *Centridermichthys*.

(Pallas, Zoogr. Rosso-Asiat. iii, 135, 1811; Cuv. & Val. iv, 177: *Megalocottus platycephalus* Gill, 1861, 166.)

aaa. Head with tentacles above; lateral line without plates. (*Porocottus** Gill.)

1085. C. verrucosus Bean.

Very dark brown, whitish below; spinous dorsal dark, with a median and a posterior light band; soft dorsal and pectorals each with 5 dark bands; anal whitish, with a dark stripe; ventrals pale. Nasal spines sharp; a short tentacle above each eye and one on each side of the vertex; vertex and interorbital space deeply concave; crown, nape, and interorbital region with small dermal warts; upper preopercular spine as long as short diameter of eye; eye 4 in head, as long as snout; maxillary reaching to below middle of eye, half length of head, longer than fourth dorsal spine. Pectoral reaching front of anal; skin smooth; lateral line with numerous short vertical accessory branches, placed opposite each other. No pore behind last gill. Head $2\frac{1}{2}$; depth $4\frac{1}{2}$. D. XI–16; A. 15; V. I, 3; P. 17; C. 12; B. 6. L. $3\frac{1}{2}$ inches. Plover Bay, near Bering's Straits. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. iv, 152, 1881.)

1086. C. niger Bean.

Almost black; sides mottled with lighter brown, sometimes with round white blotches on belly and sides; pectoral plain or with white blotches. Nasal spines blunt, covered with skin; no spines above orbits or on occiput; no sharp spines on head except the two upper preopercular spines, which are almost concealed; the uppermost as long as eye, 6 in head, and equal to snout or interorbital space; top of head with fine dermal granulations, the vertex with numerous slender tentacles; a soft tentacle of moderate length above eye; jaws equal; maxillary longer than fourth dorsal spine, 2 in head, reaching hinder margin of orbit. Caudal and ventrals each half length of head; pectoral not reaching vent; skin smooth. A small slit behind last gill. Head $2\frac{1}{2}$. D. IX–16; A. 12; V. I, 3; P. 16; B. 6. Saint Paul Island, Bering's Sea. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. iv, 151, 1881.)

1087. C. quadrifilis (Gill) J. & G.

Purplish, irregularly spotted with black; a dark spot below eye, and another on maxillary; fins mostly variegated with black; a dark spot

* Gill, Proc. Acad. Nat. Sci. Phila. 1859, 166: type *Porocottus quadrifilis* Gill. (πορος, pore; κοττός, Cottus.)

on upper axil, and another toward middle of base of pectoral. Head large, depressed, subrhomboidal; preopercle with a single hooked spine; opercle without longitudinal rib or spine; lower jaw and other parts of head with numerous large pores. Mouth moderate. Ventrals small. Skin naked; a slender filament over each eye, and one on each side of nape. Gill-membranes forming a fold across the isthmus. D. VIII–13; V. I, 3; B. 5. Bering's Straits. (*Gill.*)

(*Porocottus quadrifilis* Gill, Proc. U. S. Nat. Mus. 1859, 166.)

368.—GYMNACANTHUS Swainson.

(*Phobetor* Kröyer.)

(*Gymnocanthus* Swainson, Class. Fish. &c., 1839, 271: type *Cottus ventralis* C. & V.)

General characters and appearance of *Cottus*, but with no teeth on the vomer, and with a small but well-defined slit behind the last gill. The upper preopercular spine is armed with 2 or 3 antler-like processes, and the fins are all very large, the ventrals notably so. Marine species of the Arctic Seas. (*γυμνός*, naked; *ακάνθα*, spine.)

1088. G. pistilliger (Pallas) Gill.

Dark brown above, with traces of darker vertical bars; belly pale; males with the axillary region dusky, with many large round white spots; first dorsal blackish, with pale blotches; second dorsal with alternating oblique bands of white and blackish; anal and caudal nearly plain; pectorals and ventrals yellowish, with black cross-bars; mandible barred with black. Nasal spines small; occipital ridges low, the space between them concave, with rough plates; supraorbital ridge ending in a blunt tubercle; interorbital area with smooth skin. Eyes very large; maxillary extending to pupil; upper preopercular spine broad, much shorter than eye, with about three points; skin mostly smooth; axil prickly; inner edge of middle pectoral rays papillose (♂). Spinous dorsal very high and long, the longest spines in the male three-fourths length of head; second dorsal a little lower; anal very long, rather low; pectorals very broad, reaching past front of anal, the lower rays rapidly shortened; ventrals extremely long, the rays long-exserted, reaching past front of anal; anal papilla large. Head $3\frac{1}{3}$; depth $4\frac{2}{3}$. D. XII–16; A. 18; V. I, 3; P. 16; vert. 12 + 18. Arctic Seas, south to Norway, Alaska, and Labrador.

(*Cottus pistilliger* Pallas, in Cuv. & Val. iv, 193, 1829: *Cottus ventralis* Cuv. & Val. iv, 194: *Cottus pistilliger* Pallas, Zoogr. Ross.-Asiat. iii, 43, printed 1811, published 1831: *Acanthocottus patris* H. R. Storer, Bost. Journ. Nat. Hist. vi, 250: *Cottus ventralis* Günther, ii, 167: *Cottus pistilliger* Günther, ii, 167: *Cottus tricuspis* Reinh. Vidensk.

Selsk. Nat. Math. v, iii: *Cottus fabricii* Girard, Monogr. Cott. 59: *Cottus tricuspis* Günther, ii, 168; *Phobetor tricuspis* Kröyer, Natur. Tidskr. i, 263, 1844: Bean, Bull. U. S. Nat. Mus. xv, 127, 1879: *Cottus ventralis* Collett, Christiania Vid. Selsk. Forh. 1878, 151.)

1089. G. galeatus Bean.

Olivaceous; back with four distinct brown spots, the longest nearly twice as long as eye, and extending a little below lateral line, there blending with a wavy lateral stripe; dorsals and pectorals with interrupted black bands; lower fins plain whitish. Body elongate. A small tubercle above each eye; four preopercular spines, the longest about as long as eye, and with two or three processes. Space between eyes deeply concave, completely covered with bony granulations, as are the crown and neck; similar granulations on hinder margin of orbit, on suborbital stay and on opercles. Skin of body naked. Pectorals, and in males the ventrals also, reaching beyond vent; maxillary reaching to below eye. Head $3\frac{3}{4}$ (including caudal); depth $7\frac{1}{2}$. D. XI–16; A. 19; V. I, 3. Unalashka. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. 1881, 153.)

369.—TRIGLOPSIS Girard.

(*Ptyonotus* Gthr.)

(Girard, Proc. Bost. Soc. Nat. Hist. iv, 18, 1851: type *Triglopsis thompsoni* Grd.)

Body and head slender. Skin naked; lateral line chain-like. Teeth on vomer, none on the palatines. Eyes large, the interorbital area concave; bones of lower part of head extensively cavernous; a small but distinct slit behind last gill; gill-membranes almost free from the isthmus, forming a broad fold across it; preopercular spines straight, simple; fins large. Fresh-water fishes, closely related to *Cottus*, to which genus the single known species should, perhaps, be referred. Its relations with the group called *Oncocottus* are certainly intimate. (τρίγλα, *Trigla*; ὄψις, appearance.)

1090. T. thompsoni Grd.

Pale olivaceous, with darker blotches; upper fins faintly banded. Body elongate, very slender. Head long, depressed above; snout long and pointed; eye quite large, nearly as long as snout, much wider than interorbital space, 4 in head; jaws subequal; mouth large, the maxillary extending rather beyond middle of eye; preopercle with 4 sharp spines, the upper much shorter than pupil; cavernous structure of skull highly developed; upper surface of head smooth; gill-mem-

branes not broadly united, nearly free from isthmus. Dorsal fins well separated; spinous dorsal short and low, its height little more than length of snout; second dorsal very large, 3 times height of first, its longest rays about as long as head; anal high, half as high as second dorsal; pectoral long, reaching past front of anal; ventrals well developed; lateral line chain-like, conspicuous; skin perfectly smooth. Head 3; depth 6. D. VII–18; A. 15; V. I, 3. L. 3 inches. Deep waters of the Great Lakes.

(Girard, Proc. Bost. Soc. Nat. Hist. iv, 19, 1851; Girard, Monogr. Cott. 65: *Ptyonotus thompsoni* Günther, ii, 175, the name *Triglopsis* being set aside on account of the prior *Triglops*.)

370.—ENOPHRYS Swainson.

(*Aspicottus* Grd.: *Clypeocottus* Ayres: *Ceratocottus* Gill.)

(Swainson, Class. Fish. &c. 1839, 271: type *Cottus claviger* C. & V.)

Body short and thick, depressed anteriorly. Head very large, mailed above with rugose, bony plates; a series of large, rough, bony plates along lateral line; no scales. Teeth in villiform bands in jaws and on vomer, none on palatines; preopercle with strong, straight spines; suborbital stay broad, externally bony; gill-membranes joined to the isthmus, not forming a fold across it; a slit behind fourth gill. Dorsal fins separate, the anterior short, not notched; anal short. Intestinal canal elongate. Herbivorous, feeding chiefly on algæ. (εν, on; οφρυς, eyebrow.)

1091. E. bison (Grd.) J. & G.—*Stone Sculpin.*

Olivaceous above, variegated with blackish and reddish, yellowish below; fins olivaceous, marked with black; ventrals pale. Snout blunt; maxillary reaching beyond pupil; external bones of head rough-granular; interorbital space elevated and concave, the orbital ridge without spine; suborbital stay covering most of cheek; a ridge extending backwards from each eye, the two connected by a cross ridge at occiput; the ridges are large and rough, and the space between them is concave; preopercle with 4 spines, the upper very long, straight and rough, usually reaching past opercle, a little more than one-third head; opercular ridge very broad; subopercle with 2 diverging spines; a single series of large, rough, granular plates along sides, from opercle to base of caudal, the plates without keel or spine and growing smaller behind; spinous dorsal small, much lower than soft rays; anal short. Head $2\frac{1}{2}$; depth 4. D. VIII–12; A. 9. L. 12 inches. San Francisco to Alaska;

abundant. Resembles *Cottus bubalis*, with which it has been improperly confounded by Dr. Günther.

(*Aspicottus bison* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 130: *Clypeocottus robustus* Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 12: *Aspicottus bison* Girard, U. S. Pac. R. R. Surv. 66.)

1092. E. diceraus (Pallas) J. & G.

Greenish and reddish, marbled and spotted. Form of *E. bison*, the head large, wider than deep or long; top of head nearly as in *E. bison*, the ridges higher and very rough; orbital ridges elevated, continued backward toward the nape, the occipital ridges sharp behind; upper preopercular spine very long, rough, nearly two-thirds as long as head, with strong recurved hooks or serrations on the upper edge; lower preopercular spines strong; opercle with a longitudinal rib and no distinct spine; lateral line with a row of rough bony scutella, each with a minute central spine; skin above more or less villous or prickly, elsewhere smooth. Isthmus wide; a slit behind last gill; vomer with teeth. D. VII–14; A. 10; C. 12; P. 17; V. I, 3. L. 6 inches. Alaska and Kamtschatka. (Here described from a specimen in the British Museum.)

(*Cottus diceraus* Pallas, Nov. Act. Petrop. 1783, 354: *Cottus diceraus* Cuv. & Val. iv, 189: *Synanceia cervus* Tiles. Mém. Ac. St. Petersb. iii, 278: *Ceratocottus diceraus* Gill, Proc. Acad. Nat. Sci. Phila. 1859, 165, and 1861, 167: *Cottus diceraus* Günther, ii, 189.)

1093. E. claviger (Cuv. & Val.) Sw.

Dark brown, with 3 or 4 vertical bands; belly white. Top of head everywhere rough; two strong nasal spines; superciliary margins much elevated, with a deep groove between them; 4 preopercular spines, the upper exceedingly long and strong, extending nearly to the vertical from the end of the first dorsal, serrated and coarsely toothed on its upper margin, but without antler-like processes; "occiput with a very long cuneiform process on each side"; lateral line with bony plates, rougher than in *E. bison*, each with a serrated keel and spine; skin subvillous above, with small rough warts; a series of small cutaneous appendages above the anal. Suborbital stay spinous; vomerine teeth present; isthmus broad; slit behind last gill large. D. VI–13; A. 11; V. I, 3. L. $2\frac{1}{2}$ inches. Bering's Sea. (Here described from the original type, in the British Museum.)

(*Cottus claviger* Cuv. & Val. iv, 195, 1829: *Cottus claviger* Günther, ii, 167.)

371.—LIOCOTTUS Girard.

(*Leiocottus* Girard, Proc. Acad. Nat. Sci. Phila, 1856, 133: type *Leiocottus hirundo* Girard.)

Body elongate, covered with thick, smooth skin. Head compressed, narrowed above, not externally bony. Mouth small, horizontal, low; villi-

form teeth in both jaws and on the vomer, none on the palatines; upper preopercular spine short, strong, with bifurcated tip; suborbital stay narrow; gill-membranes partly free from the isthmus, over which they form a broad fold; a slit behind fourth gill. First dorsal with its upper margin somewhat S-shaped, the first two spines elongate, the middle ones of nearly equal length, and the posterior ones rapidly shortened; ventrals I, 3. Pacific. (*λεῖος*, smooth; *χόττος*, Cottus.)

1094. L. hirundo Grd.

Olivaceous, shaded with light blue, and reticulated with brownish-red, the latter color predominating on the head; sides with four broad, oblique, brownish-red bars, the first three running from dorsal forwards and downwards, the fourth from caudal peduncle backwards to base of caudal; abdomen orange brown, with pale spots; caudal orange brown, with yellow bars near the tip; fins with bars and spots of dark brownish-red; breast and ventrals whitish; three dark blotches at base of pectorals; spinous dorsal with oblique dark streaks; a dark blotch on each eye above, and a light streak forwards and downwards from eye. Body elongate, fusiform, the caudal peduncle slender; profile of snout decurved; maxillary reaching front of orbit; three small cirri at the end of each maxillary; preopercular margin with several similar cirri; opercle and shoulder-girdle without spines; upper preopercular spine as long as pupil. Top of head smooth; supraorbital ridges little elevated; nasal spines distant from tip of snout. Spinous dorsal elevated in front, the first two rays much longer than the others, nearly two-thirds length of head; soft dorsal and anal fins rather long; pectorals reaching past front of anal; ventrals to vent. Head $3\frac{1}{2}$; depth $4\frac{1}{2}$; eye large, $4\frac{1}{2}$ in head. D. IX–17; A. 15; V. I, 3. L. 10 inches. Santa Barbara Islands; extremely local.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 133; Girard, U. S. Pac. R. R. Surv. Fish. 62: *Cottus hirundo* Günther, ii, 166.)

372.—TRIGLOPS Reinhardt.

(Reinhardt, Vid. Selsk. Natur. Math. Afh. v, lii: type *Triglops pingeli* Reinhardt.)

Body rather elongate, the tail very slender. Head small and compressed. Mouth moderate; villiform teeth on jaws and vomer, none on the palatines; preopercular spines small, simple. Head prickly, but without scales. A row of enlarged plate-like scales along the lateral line; a similar row above it at the base of the dorsal fin; the space between these densely prickly; lower half of body crossed at short intervals by transverse undulating folds of skin, the edge of the fold with

minute rough scales, causing it to appear sharply and finely serrate. Gill-membranes united, free from the isthmus; a distinct slit behind last gill. Dorsal spines rather high and slender; ventrals apparently I, 3. Arctic seas. (*τριγλα*, Trigla; *ὄψ*, appearance.)

1095. T. pingeli Reinh.

Olivaceous, somewhat variegated with darker; fins barred; a series of dusky spots along sides; an ocellated black spot on posterior part of spinous dorsal. Head very slender; eye large, placed high, but lateral; preopercular spines short; maxillary extending to below middle of orbit; nasal spines sharp. Ventral fins rather short; pectorals extending to front of anal; tail very slender, its diameter less than the eye; anal papilla large. Head 3½. D. IX–21; A. 21. Alaska to Greenland and Cape Cod.

(Reinhardt, Vid. Selsk. Natur. v, lii; Günther, ii, 173: *Triglops pleurostictus* Cope, Proc. Acad. Nat. Sci. Phil. 1865.)

373.—LEPTOCOTTUS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 130: type *Leptocottus armatus* Grd.)

Body elongate, depressed, covered with perfectly smooth skin. Head depressed, oblong, not very broad, without cirri; lower jaw included; suborbital stay narrow; teeth on jaws, vomer, and palatines. Gill-membranes rather narrowly joined to the isthmus, not forming a fold across it; a slit behind fourth gill; preopercular spine strong, with two or three points hooked upwards. Dorsal fins separate; the spinous dorsal short and small, entire; ventrals I, 4. Pacific coast. (*λεπτος*, slender; *κοττος*, Cottus.)

1096. L. armatus Grd.

Grayish olive above, becoming abruptly white and silvery below; sides creamy; pectoral fins creamy yellow, with five or six black cross-bars; spinous dorsal dusky, with an ink-like blotch on tip of last rays, and an oblique white band below; soft dorsal dusky, with several oblique white bands; caudal banded; ventrals and anal plain. Head long and depressed; mouth large, the maxillary reaching beyond eye; interorbital space broad, scarcely concave; nasal spines concealed; top of head flattish, covered with rugose skin; upper preopercular spine with three or four spinules hooked upwards; suborbital stay slender, not reaching preopercle; eye very small, less than interocular width, 7½ in head; lateral line complete; skin everywhere smooth; no prickles nor cirri. Dorsal spines very slender and low; pectorals reaching

vent; ventrals half way to vent. Head 3 in length; depth 6. D. VII–17; A. 17; V. I, 4. L. 12 inches. Kodiak to San Diego; everywhere very common; the most abundant of the Cottoids of our west coast.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 131; Girard, U. S. Pac. R. R. Surv. Fish. 60: *Centridermichthys armatus* Günther, ii, 171.)

374.—HEMILEPIDOTUS Cuvier.

(*Temnistia* Richardson: *Calycilepidotus* Ayres.)

(Cuvier, Règne Anim. ed. 2d, 1829: type *Cottus hemilepidotus* Tilesius.)

Body with two broad bands of rough scale-like plates on each side, one along the side of the back, one along the lateral line, the upper bands meeting anteriorly in front of dorsal; scales roundish, their upper and posterior margins free; skin otherwise naked; head naked. Villiform teeth on jaws, vomer, and palatines. Branchiostegals 6. A small slit behind fourth gill; gill-membranes joined to the isthmus, sometimes forming a narrow fold across it; preopercular spines simple, strong. Dorsal fins connected, the first long, with strong spines, emarginate, the first three spines shorter than those which follow; ventrals I, 4. North Pacific. (ἡμι, half; λεπιδοτος, scaled.)

a. Belly immaculate.

1097. H. spinosus (Ayres) Grd.—*Cabezon.*

Brown, mottled and obscurely barred, often tinged with red; top of head usually with brick-red; fins all, except ventrals, mottled with blackish and reddish; skin joining bones of jaws unspotted; belly whitish, immaculate. Body rather elongate, depressed; head broad, somewhat concave between the occipital ridges; two sharp radiating ridges behind upper posterior margin of each orbit; top of head covered with loose skin, and with thick-set mucous tubes; interorbital space narrow, concave, half diameter of eye; preopercle with 2 strong, shortish, diverging spines above; fleshy slips above opercle, near upper posterior part of eye, and at occiput; a long fleshy slip on maxillary, and 4 on lower jaw; many scales on sides with small flaps; skin, where not scaly, thin and lax; dorsal band of scales with about 7 rows at its widest part, anteriorly much wider than the space between it and the lateral band; isthmus rather narrow, the membranes not forming a fold across it; dorsal fins considerably connected, spines very low, the highest about two-thirds the height of the soft rays, and $3\frac{3}{4}$ in head; first dorsal spine about half as long as maxillary; pectorals

broad, shortish, about reaching vent; distance from spinous dorsal to snout greater than length of pectoral. Head 3; depth 5. D. III, VIII, 20; A. 16; V. I, 4; Lat. l. 60. L. 10 inches. Coast of California, in rather deep water; seen by us only about Monterey and San Francisco.

(*Calycilepidotus spinosus* Ayres, Proc. Cal. Acad. Nat. Sci. i, 76, 1855; Girard, Proc. Acad. Nat. Sci. Phila. 1856, 134; Girard, U. S. Pac. R. R. Surv. Fish. 68.)

1098. H. jordani Bean.

Throat and belly pure white; upper parts brownish, with wavy darker bars. Dorsal band of scales with but 4 rows in its widest part. Eye as long as snout, 4 in head, the short diameter equal to interorbital space; maxillary extending to below middle of eye; top of head corrugated; distance of spinous dorsal from snout equal to length of pectoral; first dorsal spine as long as maxillary; longest dorsal spine $2\frac{1}{2}$ in head; pectoral reaching anal; ventral nearly or quite to vent; a narrow fold of skin across isthmus. Head $2\frac{2}{3}$; depth $4\frac{1}{2}$. D. III, VIII, 21; A. 17; V. I, 4. L. 13 inches. Unalashka.

(Bean, Proc. U. S. Nat. Mus. 1881, 153.)

aa. Belly covered with small black spots.

1099. H. trachurus (Pallas) Günther.

Olivaceous or reddish, more or less mottled and barred with darker; belly and lower parts pale, profusely covered with small blackish spots; fins all more or less speckled; skin joining bones of jaws finely spotted with black. Body robust, not depressed. Head large; interorbital space deeply concave, its width $\frac{2}{3}$ diameter of the large eye; occipital ridges low and broad; bones of top of head extremely rough, naked; with radiating striæ, but without spines; small flaps over posterior part of eye, at occiput, over opercle, and on cheek, maxillary, preorbital, mandible, and tip of snout. Skin thick and firm; gill-membranes forming a slight fold across the isthmus; upper band of scales of about 4 rows, narrower anteriorly than the interspace; first three spines of dorsal about equal, lower than those following; soft dorsal high. Head $2\frac{3}{4}$; depth $3\frac{1}{2}$. D. III, VIII, 19; A. 15; V. I, 4; Lat. l. 61. L. 18 inches. Alaska to San Francisco; abundant in Puget Sound; a much larger fish than *H. spinosus*, and readily distinguished by the spotted belly.

(*Cottus hemilepidotus* Tiles. Mém. Ac. Petersb. iii, 262, 1801: *Cottus trachurus* Pallas, Zoogr. Ross -Asiat. iii, 138, 1811: *Hemilepidotus tilesii* Cuv. & Val. iv, 276, 1829; Günther, ii, 173: *Blepsias ventricosus* Eschscholtz, Zoöl. Atlas, 3d Heft, 14, t. 13: *Temnistia ventricosa* Richardson, Faunæ Bor.-Amer. Fish. 1836, 59: *Hemilepidotus gibbsi* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 13.)

375.—MELLETES Bean.

(Bean, Proc. U. S. Nat. Mus. 1879, 354: type *Melletes papilio* Bean.)

Body moderately elongate. Head broad, depressed, rounded in front, naked, with several cutaneous flaps; jaws, vomer, and palatines with bands of villiform teeth; preopercular spines simple, rather strong; gill-membranes broadly connected, free from the isthmus; a slit behind the last gill; a narrow band of ctenoid scales along sides of back, meeting in front of dorsal; a few prickles on anterior parts of body, and some small dermal flaps on sides; skin otherwise naked; dorsals connected; the spinous dorsal long, not emarginate; pectorals well developed, the rays all simple; ventrals very long, I, 4, the inner surface of the rays armed with stiff setæ; pyloric cœca 6; no air-bladder. Alaska. (*μηλλητης*, a loiterer; remaining in shallow pools as the tide recedes.)

1100. M. papilio Bean.

Grayish brown, with darker bands and various mottlings; belly grayish, with round white spots; fins all much mottled and barred. Nasal spines obtuse; 2 spines above posterior part of orbits, and 2 on the vertex, the last four with short filaments. Ventrals 2 in length, longer than pectorals, extending to the seventh anal ray (♂). Head 4; depth $2\frac{2}{3}$. D. XII, 20; A. 17; P. 17; V. I, 4. L. 7 inches. Saint Paul's Island, Alaska.

(Bean, Proc. U. S. Nat. Mus. 1879, 354.)

376.—SCORPÆNICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 131: type *Hemitripterus marmoratus* Ayres.)

Body rather robust, covered with smooth, thick skin. Head large, somewhat compressed, its upper surface rugose. Mouth rather large, with villiform teeth on jaws, vomer, and palatines; gill-membranes broadly united, free from the isthmus; a large slit behind fourth gill; preopercular spines small, simple; spinous dorsal long, scarcely emarginate, but slightly depressed near its middle, the first four spines shorter than those immediately following; ventral fins large, I, 5. Size large. Pacific Ocean. (*σκορπαινα*, Scorpæna; *ἰχθύς*, fish.)

1101. S. marmoratus (Ayres) Grd.

Olive brown, thickly mottled with dark blotches and light spots, and reticulated with different shades of green and brown; sides with 5 irregular, dark, vertical blotches, of which two are under each dorsal and

extend on the fins; belly livid bluish or green, reticulated with olive; the ground color is exceedingly variable, ranging from cherry-red to green; lips blotched with white; fins all more or less barred; flesh and membranes livid bluish. Top of head rugose, without spines; interorbital space concave, narrower than the large eye; a fleshy flap on middle of snout, and one on end of maxillary; superciliary cirri large, more than half diameter of orbit, laciniate; upper preopercular spine short, straight, about half diameter of eye; suborbital stay very broad; maxillary extending to beyond eye. First four spines of dorsal subequal, shorter than the fifth; dorsal fins scarcely connected at base; pectorals shortish, not reaching anal. Skin thick and leathery, without prickles or cirri. Head 3; depth 4. Eye 6 in head. D. XI–18; A. 12; P. 15; V. I, 5; Lat. l. (pores) 80; pyloric cœca about 30; vertebræ 15 + 21. L. 30 inches. Puget Sound to San Diego; very abundant. The largest of our *Cottidæ*, reaching a weight of 10 to 15 pounds.

(*Hemitripterus marmoratus* Ayres, Proc. Cal. Acad. Sci. 1854, 4; Girard, U. S. Pac. R. R. Surv. Fish. 64; Günther, ii, 154.)

377.—OLIGOCOTTUS Girard.

(*Clinocottus* and *Blennicottus* Gill.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 133: type *Oligocottus maculosus* Girard.)

Body rather elongate, the skin smooth or provided with some small prickly scales; preopercular spines short, simple or furcate; small tentacles on head and anterior parts of body; gill-membranes broadly united, free from the isthmus; a slit behind fourth gill; dorsal spines slender, the fin short and not emarginate; anal papilla large; ventrals I, 3, or I, 4. Small fishes of the North Pacific, inhabiting rock-pools between tide-marks. (*ὀλιγος*, small; *κοττος*, Cottus.)

a. Mouth with distinct lateral cleft; the head narrow anteriorly.

b. Skin with imbedded, prickle-like scales. (*Clinocottus* Gill.*)

1102. O. analis Grd.

Olivaceous, much mottled, and with numerous small black and white spots; about five irregular darker bars; a dark bar at base of caudal; fins all spotted; cirri very numerous, mostly whitish, giving the fish a woolly appearance in life. Head narrower anteriorly and rather pointed; mouth with lateral cleft, the maxillary reaching beyond pupil; band of palatine teeth short and narrow; eye large, 5 in head, about twice the width of the deeply-grooved interorbital space; nasal spines distant

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*Gill, Proc. Acad. Nat. Sci. Phila. 1861, 166: type *Oligocottus analis* Grd. (*Clinus; Cottus.*)

from snout; preopercular spine short, bifurcate; cranium plane above. Upper part of body mesially, covered with minute, imbedded, non-imbricated, pectinate scales; anteriorly, small cirri, mostly bifid or trifid, take the place of the scales. Head, especially above, with very many similar cirri; a fringe of cirri on edge of preopercle. Dorsal fins contiguous, rather low; pectoral reaching past front of anal. Anal papilla very large. Head $3\frac{1}{2}$; depth $4\frac{1}{2}$. D. IX–17; A. 14; V. I, 3; P. 16. L. 7 inches. Coast of California; abundant in rock-pools from Monterey southward to Lower California.

(Grd., Proc. Acad. Nat. Sci. Phila. 1857, 201; Girard, U. S. Pac. R. R. Surv. Fish. 57: *Centridermichthys analis* Günther ii, 171: *Cottus criniger* Günther ii, 522.)

bb. Skin without scales or prickles. (*Oligocottus.*)

1103. O. maculosus Grd.—*Johnny.*

Usual color reddish brown, varying to gray, intense green or crimson according to surroundings, the vivid colors developed in the presence of similarly colored algæ; fins all barred; belly usually livid bluish or greenish; lower side of head with white mottlings; northern specimens with an ocellated black spot on front of spinous dorsal. Head slender, narrowed above, the snout rather pointed; maxillary reaching pupil; top of head with several scattered cirri; a few on sides of head, none on edge of preopercle; cirri on lateral line anteriorly and on front of back, also on base of spinous dorsal. No scales or prickles anywhere; preopercular spine forked. Front rays of anal enlarged and partly detached in ♂; anal papilla large (in ♂); pectorals reaching well beyond front of anal. Head $3\frac{2}{3}$; depth $4\frac{1}{2}$. D. VIII–16; A. 12. L. 3 inches. San Luis Obispo to Alaska, exceedingly abundant northward; one of the smallest of marine *Cottidæ*.

(Girard, Proc. Acad. Nat. Sci. Phila. 1856, 153; Girard, U. S. Pac. R. R. Surv. Fish. 56: *Centridermichthys maculosus* Günther, ii, 171.)

aa. Mouth with very little lateral cleft; the head globoid. (*Blennicottus** Gill.)

1104. O. globiceps Grd.

Dark olive, with obscure darker cross-bars; first dorsal with 2 dark streaks above; fins generally barred with greenish, orange, or blue; cirri mostly black. Body little compressed; head extremely short and blunt, narrowed above, nearly everywhere convex. Mouth anterior, short and broad, almost without lateral cleft; lower jaw shortest; maxillary reaching past front of the small eye; interorbital space very nar-

*Gill, Proc. Acad. Nat. Sci. Phila. 1861, 166: type *Oligocottus globiceps* Grd. (*Blennius*; *Cottus.*)

row, grooved, about half width of eye; preopercular spine with a single point turned upwards; top of head with two series of cirri; none on sides of head, except a few on upper part of opercle; a series of cirri along anterior half of lateral line; skin without scales or prickles; pectorals reaching beyond front of anal. Head $3\frac{3}{4}$; depth $4\frac{1}{4}$. D. IX–16; A. 11; V. I, 3. Northern specimens are larger in size, with paler and more variegated coloration and red markings; the dorsal has one or two more rays, the preopercular spine is stronger and slightly hooked upwards, and the opercle has many more cirri above than in the southern form. Pacific coast, from Monterey northward to Kodiak; in rock-pools; rather rare.

(Girard, U. S. Pac. R. R. Surv. Fish. 1858, 58: *Centridermichthys globiceps* Günther, ii, 171.)

378.—BLEPSIAS Cuvier.

(*Peropus* Bennett: *Histiocottus* Gill.)

(Cuvier, Règne Animal, 1829, ed. 2d: type *Trachinus cirrhosus* Pallas.)

Head and body compressed; skin hispid with stiffish villiform prickles, sometimes with definitely naked areas; snout and chin with several rather long barbels; mouth small; teeth villiform, on jaws, vomer, and palatines; preopercle with two short blunt spines; gill-membranes free from the isthmus; gills four, a slit behind the fourth; top of head with bony ridges; suborbital stay narrow; first dorsal short, elevated in front, the spines slender; second dorsal large; anal similar, lower; ventrals very short, I, 3; pectorals long. Pacific coast. (An old name of some fish; from $\beta\lambda\varepsilon\pi\omega$, to look.)

a. Spinous dorsal emarginate; sides with naked areas.

1105. B. cirrhosus (Pallas) Günther.

Dark olivaceous, sides of back with four to six vertically oblong black blotches edged with paler, not reaching nearly to lateral line; belly and naked areas on sides whitish; black bands radiating from eyes; fins dark, with large pale blotches and dark spots; caudal with light and dark bars; ventrals plain; a small white spot on front of spinous dorsal. Supraocular ridges well developed; interorbital space concave, with two low ridges extending backwards from nasal spines, diverging towards occipital ridges; the latter large, partly interrupted; suborbital stay conspicuous; temporal ridge present; maxillary reaching to beyond middle of pupil; snout with five barbels, chin with six, the longest about as long as the eye, which is $3\frac{2}{3}$ in head; a small cirrus

on each interorbital ridge; interorbital space as wide as eye; sides with three or four pale, well-defined, naked areas behind pectorals, the two anterior much the largest; behind these a long naked strip along the lateral line, colored like the rest of the body; first four spines of dorsal elevated, $\frac{2}{3}$ to $\frac{3}{4}$ length of head; the fifth much shortened; membrane deeply notched between the fifth spine and the sixth, which is longer than the one before it; ventrals as long as eye; pectorals reaching much beyond front of anal; first rays of soft dorsal short; the others gradually lengthened to near the last, the highest higher than the dorsal spines; caudal longer than head. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$. D. V, III–23; A. 20; P. 12; Lat. l. 50. L. 6 inches. North Pacific, south to San Francisco.

(*Trachinus cirrhosus* Pallas, Zoogr Ross.-Asiat. iii, 237, 1811: *Blepsias trilobus* C. & V. iv, 375, 1829; Günther, ii, 153; Steindachner, Ichth. Beiträge, v, 128, 1876.)

aa. Spinous dorsal not emarginate; no naked areas.

1106. B. bilobus Cuv. & Val.

Olivaceous, paler below; dorsal region with 4–5 black bars, reaching one-third the distance to the lateral line, and somewhat continued on the fins; caudal with a black bar at base, otherwise plain; pectorals and anal blotched with black. Body shorter and deeper than in *B. cirrhosus*, with thicker caudal peduncle and heavier head, the bones less firm; snout short, obtuse; interorbital space very wide, concave, half wider than the small eye; short occipital ridges present, besides several bluntish tubercles. Mouth broad, oblique, the maxillary reaching pupil; teeth small, distant; barbels as in *cirrhosus*. Head and body covered with prickles, larger and blunter than in *cirrhosus;* no naked patches on body; fins less developed than in *cirrhosus;* first five or six spines of dorsal subequal, the last three abruptly shorter; pectorals longer and much broader than in *cirrhosus*, reaching seventh anal ray; caudal short, much shorter than head. D. IX–21; A. 18; P. 16. Coasts of Alaska and Kamtschatka; the specimen here described from Kodiak.

(Cuv. & Val. iv, 379, 1829: *Peropus bilobus* Bennett, Beechey's Voy. Zoöl. Fish. 59; Günther, ii, 153.)

379.—NAUTICHTHYS Girard.

(Girard, U. S. Pac. R. R. Surv. Fish. 1858, 74: type *Blepsias oculofasciatus* Girard.)

Body rather elongate, compressed, but not elevated, the skin evenly covered with short, close-set, villiform prickles. Head short, strongly

compressed, the cheeks subvertical; orbital ring much elevated above, with several blunt protuberances behind; nape much depressed, with the base of the dorsal fin rising abruptly above it; mouth small; teeth on jaws, vomer, and palatines; preopercle with small bluntish spines above; gill-membranes broadly united to the isthmus; a slit behind fourth gill; branchiostegals 6; first dorsal falcate, the spines very flexible, the anterior much elevated, much longer than head, the posterior rapidly shortened; second dorsal long and rather high; anal fin similar to second dorsal, but shorter and lower; pectorals moderate; ventrals I, 3, well developed, nearly as long as head. Pacific coast. Small fishes, of singular appearance. (*ναύτης*, sailor; *ἰχθύς*, fish; in allusion to the development of the first dorsal fin.)

1107. N. oculofasciatus Grd.

Grayish above; sides with dark marblings and obscure dusky bands; a very conspicuous black band through the eye and across cheeks; first dorsal blackish; other fins barred with light and dark; ventrals plain. Maxillary reaching to opposite pupil; eye very large, longer than snout; nasal spines conspicuous, curved; maxillary and edge of preopercle with minute cirri; orbit with a branched cirrus, as long as pupil; the narrow interorbital space deeply channelled; supraocular ridge posteriorly with 3 blunt tubercles; 2 compressed tubercles on each side of first dorsal; a deep pit at nape, extending under origin of first dorsal; spinous dorsal smooth; rays of soft dorsal and caudal roughened with prickles; dorsal spines nearly twice length of head; ventrals $\frac{3}{4}$ length of head, a little shorter than caudal; pectorals long. Head $3\frac{1}{2}$; depth $3\frac{3}{4}$. D. IX–28; A. 19; P. 14; V. I, 3; Lat. l. 44. L. 6 inches. Pacific coast, San Francisco to Unalashka; chiefly northward.

(*Blepsias oculofasciatus* Girard, Proc. Acad. Nat. Sci. Phila. 1857, 202; Günther, ii, 157; Steindachner, Ichth. Beiträge, v, 130.)

380.—RHAMPHOCOTTUS Günther.

(Günther, Ann. Nat. Hist. xiv, 369, 1874: type *Rhamphocottus richardsoni* Günther.)

Body short, elevated. Head very large, its greatest depth greater than that of the body; skull with 2 strong bony ridges from above the front of the eye, continuous with 2 large occipital ridges, leaving the interorbital space and middle line of the top of the head strongly concave; snout slender, narrow, and abruptly protruding; mouth very narrow, ∩-shaped, its gape longer than wide; teeth villiform, none on the vomer or palatines; gill-opening confined to the region above the

base of the pectorals, the membranes below completely united to the shoulder girdle and isthmus; apparently no slit behind last gill; a stout, straight, preopercular spine; nasal spines present; no other spines on head. Skin everywhere on head and body firm, immovable, densely covered with stiff bifid or trifid spinous prickles; spinous dorsal very small; pectoral with procurrent base. (*βαμψος*, snout; *κοττος*, Cottus.)

1108. R. richardsoni Gthr.

Brownish, with 6 or 8 oblique black bands running downward and forward; a white bar below eye; a dusky bar at bases of pectorals and ventrals, the fins otherwise plain. Head hard and bony, nearly as long as rest of body; snout rather longer than eye, which is of moderate size, and with partly vertical range; maxillary extending to front of eye; suborbital stay strong; pectorals long, reaching tips of ventrals and past front of anal; ventrals long, their rays prickly. Head 2; depth 2. D. VII–14; A. 7 or 8; V. ca. I, 4. L. $2\frac{1}{3}$ inches. Northern seas. Three specimens known: the one here described from Bering's Straits; the original, said to be from "Fort Rupert"; a third recently obtained by Mr. Lockington, from the stomach of a *Sebastodes*, at Monterey.

(Günther, Ann. Mag. Nat. Hist. xiv, 370, 1874; Bean, Proc. U. S. Nat. Mus. 1881, 252.)

Family CVIII (*a*)—AGONIDÆ.*

(*The Alligator-fishes.*)

Body elongate, or more or less elevated, angular, covered with about eight longitudinal series of large bony plates, which form a coat of mail;

*The following genera and species of this type have been described from Kamtschatka and the Kurile Islands, and will doubtless be found on our Alaskan coast:

HYPSAGONUS Gill.

(Gill, Proc. U. S. Nat. Mus. 1861, 259: type *Aspidophorus quadricornis* Cuv. & Val.)

Body compressed and elevated, its depth greater than length of head, more than one-third the body; head small, separated from the base of the dorsal by a very deep nuchal depression; top of head very uneven; mouth terminal, the jaws about equal; no vomerine teeth; gill-membranes undescribed, probably free from isthmus; no barbels; scales large, not very rough, most of them striate and armed with a central spine or tubercle; dorsal spines strong, the first serrated; pectorals short, procurrent; ventrals small. (*ὑψι*, high; *Agonus*.)

H. quadricornis (Cuv. & Val.) Gill.

Two horns above eye and 2 above occiput; interorbital space nearly as broad as

head externally entirely bony, the plates often spinous; eyes large, placed high; suborbital stay cuirassing the cheek; mouth terminal or inferior; barbels often present; teeth small, in villiform bands, on the jaws, and often on the vomer and palatines also; gills $3\frac{1}{2}$, no slit behind the last; pseudobranchiæ very large, usually extending down the inner side of the opercle; gill-rakers small; gill-membranes united, free or joined to

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eye; 2 small spines above snout; dorsals well separated. Head $3\frac{3}{4}$; depth 3. D. IX-6; A. 10; Lat. l. 33. Kamtschatka. (*Günther.*)

(*Aspidophorus quadricornis* Cuv. & Val. iv, 221, 1829: *Agonus quadricornis* Günther, ii, 215.)

HIPPOCEPHALUS Swainson.

(Swainson, Class. Fish. &c., 1839, 272: type *Aspidophorus superciliosus* Cuv. & Val.)

Body moderately elongate, compressed, the head depressed at the nape; dorsal spines strong, the first inserted close behind the nape; dorsals well separated; jaws equal, or the lower slightly the longer; breast granulated; gill-membranes not described, probably free. (*ιππος*, horse; *κεφαλη*, head.)

H. japonicus (Pallas) Gill.

Yellowish brown, the body banded and the fins with dark lines. Top of head not very rough; a flat triangular prominence, directed upward and outward above each eye, concealing the eye when viewed from above; 2 spines above the snout; suborbital with 2 or 3 spines, one of them with a barbel; suborbital stay broad, gibbous; barbels small; bony plates rough-striate, pyramidal, the center raised; ventrals half as long as pectorals; dorsals separated by a space greater than length of either; fins all very rough. Depth 5. D. VI–17; A. 8; Lat. l. 45. L. 12 inches. Kurile Islands. (*Cuv. & Val.*)

(*Cottus japonicus* Pallas, Spicilegia fasc. vii, 31, 1772: *Agonus curilicus* and *Agonus stegophthalmus* Tilesius, Mém. Ac. Petersb. iv, 416, 427: *Aspidophorus superciliosus* Cuv. & Val. iv, 215: *Agonus stegophthalmus*, Günther, ii, 214.)

Brachyopsis dodecaëdrus (Tiles.) Bean.

Brownish, body and fins banded. Body elongate; snout obtuse, depressed, without spines; mouth nearly vertical, the lower jaw considerably produced; interorbital space as wide as eye; suborbital with spines; breast with many small convex polygonal plates; keels of the scales ending in a small point. Head 5; depth 8. D. XI–7; A. 15; P. 15; V. I, 2; Lat. l. 40. Kamtschatka; common. (*Cuv. & Val.*)

(*Agonus dodekaëdrus* Tiles. Mém. Ac. Petersb. iv, pl. 13, 1811: *Phalangistes loricatus* Pallas, Zoogr. Ross.-Asiat. iii, 114: *Aspidodophorus dodecaëdrus* Cuv. & Val. iv, 209: *Agonus dodecaëdrus* Gthr. ii, 214.)

Siphagonus segaliensis (Tiles.) Steind.

Yellowish brown; fins with black bands. Form resembling *Brachyopsis rostratus*, but the tail shorter; body depressed; eye behind middle of head; two spines on the suborbital, and some others about eyes; dorsals contiguous; anal longer than second dorsal; no barbels under the throat; gill-membranes and barbels at chin undescribed. D. VII–8; A. 12; C. 10; P. 14; V. I, 2. L. 7 inches. Island of Saghalien. (*Cuv. & Val.*)

(*Syngnathus segaliensis* Tiles. Mém. Soc. Imp. Nat. Moscou, ii, 216: *Agonus lævigatus* Tilesius, Mém. Acad. Petersb. iv, 436: "*Aspidophore lisse*" Cuv. & Val. iv, 214.)

the isthmus; ventral fins thoracic, close together, imperfect, I, 2 or I, 3; spinous dorsal small, sometimes absent; anal short, similar to soft dorsal, without spines; caudal narrow, few-rayed; pectorals entire, with broad base, the rays mostly simple; pyloric cœca few; air-bladder none. Small fishes, chiefly of the Arctic Seas. Genera about 10; species about 16. They feed chiefly on Crustacea, and are often found at considerable depths.

(*Triglidæ*, group *Cataphracti* pt. Günther, ii, 211–216.)

a. Spinous dorsal obsolete; gill-membranes free from the isthmus. (*Aspidophoroidinæ.*)
ASPIDOPHOROIDES, 381.

aa. Spinous dorsal present.

b. Gill-membranes free from the isthmus; lower jaw projecting.

c. Body extremely elongate; snout forming a tube; chin with a single long barbel.....SIPHAGONUS, 382.

cc. Body fusiform, less elongate; snout not forming a tube; chin without barbel.
BRACHYOPSIS, 383.

bb. Gill-membranes united to the isthmus, lower jaw included.

d. Bony plates of body without spines.

e. Vomerine teeth none; no occipital pit.....AGONUS, 384.

ee. Vomerine teeth present; a deep pit at the occiput....BOTHRAGONUS, 385.

dd. Bony plates of body ending in spines.

f. Vomerine teeth present.....ODONTOPYXIS, 386.

ff. Vomerine teeth none.....PODOTHECUS, 387.

381.—ASPIDOPHOROIDES Lacépède.

(*Anoplagonus* Gill.)

(Lacépède, Hist. Nat. Poiss. iii, 228, 1802: type *Aspidophoroides tranquebar* Lac. = *Cottus monopterygius* Bloch.)

Body very long and slender, subterete, octangular, tapering into a very long six-sided tail. Head slender, short, with large eye; mouth small, terminal; jaws and vomer with villiform teeth. Dorsal fin single, without spines, very small, inserted nearly opposite the still smaller anal; other fins small; bony plates of body keeled, without spines; gill-membranes broadly united, free from the isthmus. (ἀσπὶς, shield; φορέω, to bear; ειδος, appearance.)

a. Nasal spines very strong.

1109. A. monopterygius (Bloch) Storer.

Brownish, obscurely banded with darker; pectorals, dorsal, and caudal mottled or barred. Head triangular, much narrowed anteriorly; nasal spines very large, diverging, inserted near tip of snout; no other spines anywhere; eyes very large, longer than snout; supraocular ridges very high; a ridge extending backward from eye along tem-

poral region; lower jaw slightly included; caudal peduncle very long and slender, forming about two-fifths the length; breast with flat plates; dorsal ridges high anteriorly, the median line of back from snout to dorsal fin concave. Head $5\frac{2}{3}$; depth 9. D. 5; A. 6; Lat. l. about 50. L. 6 inches. Polar regions, southward to Cape Cod; abundant in deep water.

(*Cottus monopterygius* Bloch, Ausländische Fische, ii, 156, taf. 178; Günther, ii, 216.)

aa. Nasal spines obsolete. (*Anoplagonus* Gill.)

1110. A. inermis Günther.

Black, obscurely marbled with grayish and brownish; dorsal grayish, marbled with black; caudal black, with a gray band; anal yellowish, with a black dot behind each ray. Body anteriorly much broader than high. Head flat, depressed, triangular; nasal spines obsolete; lower jaw projecting; interorbital space grooved, narrower than the orbit; eye less than snout, 5 in head; pectorals shorter than head; ventrals small; breast with about 16 plates. Head 5 in total length; depth 14; width 9. D. 5; A. 5; C. 10; P. 10; V. 2; Lat. l. 41. Vancouver's Island. (*Günther.*)

(Günther, ii, 524: *Anoplagonus inermis* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 167.)

382.—SIPHAGONUS Steindachner.

(Steindachner, Ichth. Beiträge, v, 140, 1876: type *Syngnathus segaliensis* Tiles.)

Form of *Syngnathus;* snout produced in a tube; lower jaw projecting beyond upper, with a long barbel at the symphysis; gill-membranes free from the isthmus; both dorsals present; ventrals very short; plates of body slightly keeled, without spine. (Latin, *sipho*, tube; Agonus.)

1111. S. barbatus Steind.

Brownish, a lengthwise black band on sides of head, becoming obsolete behind. Body very slender, subterete; median line of head and back concave; snout produced into a long moderately-compressed tube, the single barbel at the chin about twice the length of eye; teeth on vomer; snout and orbital rim without spines; eye in middle of head; suborbital narrow, unarmed; preopercle with 3 spines; large polygonal scales on the breast; pectorals long, reaching dorsal; ventrals very short, the vent close behind them. Head 4; depth = length of snout, 9. D. VI–7; A. 9; P. 12; Lat. l. 44. L. 6 inches. Coasts of Alaska and Japan; not rare.

(Steindachner, Ichth. Beiträge, v, 140, 1876.)

383.—**BRACHYOPSIS** Gill.

(*? Leptagonus* Gill.)

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 259: type *Agonus rostratus* Tilesius.)

Body elongate, fusiform, low, covered with spinous plates. Head depressed, spinous; mouth comparatively large, very oblique, the lower jaw projecting; jaws, vomer, and palatines with small teeth; gill-membranes united, free from the isthmus; barbels few; spinous dorsal well developed; ventral rays I, 2. (*βραχυς*, short; *οφις*, face.)

1112. B. rostratus (Tilesius) Gill.

Body more fusiform than in other species of this genus, very robust in front of the middle, tapering to the slender tail. Head triangular and pointed, as seen from above, the mouth quite narrow; eyes small, well forward; head considerably depressed, snout without spine; a short flap at angle of mouth; scales not very rough; gill-membranes free from the isthmus; ventrals quite short; breast with a median row of large raised convex plates; a row of similar plates bordering the edge of the gill-opening, the three series forming a ⩚-shaped figure, the interstices filled with very small plates. "D. VIII–8; A. 13"; Lat. l. 36. L. 8 inches. Alaska and Kamtschatka; here described from specimens lately obtained by Dr. Bean.

(*Agonus rostratus* Tiles. Mém. Acad. Petersb. iv, pl. 14: *Phalangistes fusiformis* Pallas, Zoogr. Ross.-Asiat. iii, 116: *Agonus rostratus* Günther, ii, 214.)

1113. B. verrucosus Lockington.

Olivaceous, banded with darker; pectorals whitish at base, with a dark spot above and below; terminal portion dark; ventrals bright orange-yellow with a large black spot inside of the first ray, and two small spots near the tip in ♂, the fin plain in ♀. Body elongate, depressed; mandible narrow, not one-fourth as deep as long; maxillary reaching slightly beyond front of eye, with a short barbel at tip; length of barbel ¼ that of eye; ridges on head all rough; supraocular ridges serrate; occipital and postorbital ridges without spines; preorbital with about six spines; suborbital stay with two; preopercle with two spines near its angle; opercle without spines; membrane of mandible with small stellate tubercles; plates on body rough, each with a keel terminating in a strong spine; the dorsal plates with small prickles also; breast and base of pectoral fin with large, striate, wart-like tubercles; plates of ventral series tubercular anteriorly; upper lateral series of

plates reaching head; pectorals reaching the eleventh plate; ventrals extending beyond front of anal in ♂, much shorter in ♀; the membrane between the rays very broad; anal papilla small. Head $4\frac{1}{4}$; depth 8. D. IX–7; A. 11; V. I, 2; P. 14; C. 10; Lat. l. 35. L. 8 inches. Coast of California; abundant in deep water.

(Lockington, Proc. U. S. Nat. Mus. iii, 60, 1880 (May 6): *Agonus* (*Brachyopsis*) *barkani* Steind. Ichth. Beiträge, ix, 253, 1880 (July 15).)

1114. B. xyosternus J. & G.

Light olive brown, finely reticulated with darker, pale below; mandible, and sides of head below eye bright silvery; pectoral blackish, with a large light blotch at base below and a broad pale tip; caudal entirely black; dorsal nearly plain; ventrals plain; anal white anteriorly, abruptly black behind. Form of *B. verrucosus*, but rather stouter and less depressed; breast covered with minute prickles; plates of body with spines as in *B. verrucosus*, but without smaller prickles; ventral fins short, reaching, even in the male, little more than half way to anal; the connecting membrane of the rays very narrow; maxillary barbel long, three-fourths the diameter of the eye; mandible very deep, more than one-third as deep as long; upper lateral series of plates obsolete from front of first dorsal forward. Head $4\frac{1}{2}$; depth 7. D. VI–6; A. 8; V. I, 2; P. 17; Lat. l. 30. L. $5\frac{1}{2}$ inches. About Monterey and San Francisco; common about Santa Cruz.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. iii, 152, 1880 (July 2): *Agonus* (*Brachyopsis*) *annæ* Steindachner, Ichth. Beiträge ix, 254, 1880 (July 15).)

1115. B. (?) **decagonus** (Bloch & Schneider) J. & G.

Yellowish brown, marbled with darker. Body elongate, compressed; head depressed; jaws equal; a pair of spines above the snout, a second above the orbits, a third on the nape, the latter the largest; barbels very short and thick; scales with very prominent spines; six series of scales between the ventral fins and the vent; four between the vent and the anal fin; pectoral fins much longer than head, one-fourth total with caudal. D. VI–7; A. 8; P. 14; Lat. l. 41. Greenland to Norway. (*Günther.*)

(*Agonus decagonus* Bl. & Schn. 1801, 105: *Agonus decagonus* Günther, ii, 215: *Agonus decagonus* Collet, Norges Fiske, 1875, 40: *Archagonus decagonus* Gill: *Aspidophorus spinosissimus* Kröyer, Naturhist. Tidsskr. i, 250, 1844: *Agonus spinosissimus* Günther, ii, 214: *Leptagonus spinosissimus* Gill, Proc. Acad. Nat. Sci. Phila. 167, 1861.)

384.—AGONUS Bloch & Schneider.

(*Aspidophorus* Lacépède: *Phalangistes* Pallas.)

(Bloch & Schneider, Syst. Ichth. 104, 1801: type *Cottus cataphractus* L.)

Body low; head broad, depressed, about as broad as long; mouth small, subinferior, the lower jaw included; no vomerine teeth; gill-membranes joined to the isthmus, forming a narrow fold across it; plates on body without spines; fins short. One species known. (*a*, without; *γωνος*, joint: *i. e.*, rigid.)

1116. A. cataphractus (L.) Bloch & Schneider.—*Sea Poacher.*

Brownish, sides with some dark bands; pectorals and upper fins barred. Body anteriorly very broad, flattened below, tapering abruptly forward to the triangular snout, and slowly backward to the long and slender tail; the greatest width is half more than the greatest height and 5 times the least height; snout with four sharp, hooked spines projecting much beyond the horizontal ∩-shaped mouth; lower jaw profusely covered with thickish barbels, the largest longer than eye; suborbital narrow, with three blunt bony projections; preopercle and subopercle each with a stout spine, that on subopercle the larger and hooked backward; bones of head striate; orbital crests elevated, roughish; interorbital space broader than eye; top of head little uneven, without spines; two blunt occipital processes; no nuchal depression; the space between dorsal ridges concave; plates on body rugose; lateral plates much smaller than others, the upper lateral series obsolete from middle of spinous dorsal forward, in which region the lower lateral series is much enlarged; breast with four quadrate plates forming a square. Dorsal small; pectoral about as long as head, reaching to within four plates of anal; ventrals short, reaching little beyond vent, $6\frac{2}{3}$ in length. Head about as broad as long, $4\frac{1}{2}$; depth 6. D. V–7; A. 5; Lat. l. 35; cœca 5; vertebræ 11 + 25. Northern Europe; recorded, perhaps erroneously, from Greenland.

(*Cottus cataphractus* L. Syst. Nat. i, 451: *Aspidophorus armatus* Lacép. iii, 222; Günther, ii, 211; Day, Fishes Great Britain, 1881, 67.)

385.—BOTHRAGONUS Gill. .

(Gill, Bull. U. S. Nat. Mus. xi, ined.: type *Hypsagonus swani* Steindachner.)

Body rather short and deep, broad and depressed anteriorly, compressed behind; a deep nuchal pit; mouth subinferior, the lower jaw included; head and neck to the dorsal fin rhombic in outline, as seen from above; jaws and vomer with teeth; dorsals small, well separated;

anal similar to soft dorsal; ventral I, 2; plates without spines or keels; no spines on head. Gill-membranes broadly united to the isthmus. North Pacific. (*βοθρος*, a cavity; *αγωνος*, Agonus.)

1117. B. swani (Steindachner) Gill.

Clear yellowish; a blackish cross-bar downwards and forwards from base of first dorsal; another between the dorsals, and a third behind dorsal and anal; a dusky bar across interorbital space and through eye; fins all mottled or barred. Nuchal pit broader than long, the plates behind sending three processes into it; top of head with two broad parallel ridges, the space between them transversely concave; preopercular margin denticulated; breast with large plates, similar to those on sides of body. Head $3\frac{1}{4}$; depth $3\frac{1}{4}$. D. III–5; A. 5; P. 12; C. 12; V. I, 2; Lat. l. 32. Puget's Sound; one specimen known. (*Steindachner.*)

(*Hypsagonus swanii* Steindachner, Ichth. Beiträge, v, 144, 1876.)

386.—ODONTOPYXIS Lockington.

(Lockington, Proc. U. S. Nat. Mus. ii, 328, 1879: type *Odontopyxis trispinosus* Lock.)

The genus differs from *Podothecus* chiefly in the presence of vomerine teeth. The body is very slender, and the fins few-rayed. (*οδων*, tooth; *πυξις*, box.)

1118. O. trispinosus Lock.

Olivaceous, with six or seven darker bands; fins with dark blotches. A sharp, rather long, movable spine upon the tip of the snout, its triangular base projecting beyond the jaws; behind this a pair of recurved, fixed spines; supraorbital ridge prominent, ending in a backward-directed spine; maxillary with two minute barbels; isthmus broad; eye very large; forehead strongly convex, longitudinally transversely strongly concave; a deep nuchal cavity divided by a longitudinal ridge; preorbital with a spine directed backward; eye large; a circlet of horizontal spines at base of caudal. Head $5\frac{1}{2}$ in total length; depth 10 to 12; eye $3\frac{2}{3}$ in head. D. IV–6; A. 6; V. I, 2; P. 14; C. 11; Lat. l. 36. L. 3 inches. Pacific Coast from San Francisco to Santa Barbara.

(*Odontopyxis trispinosus* Lockington, Proc. U. S. Nat. Mus. ii, 328, 1879.)

387.—PODOTHECUS Gill.

(*Paragonus* Gill.)

(Gill, Proc. Nat. Sci. Phila. 1861, 259: type *Podothecus peristethus* Gill = *Agonus acipenserinus* Tiles.)

Body elongate, fusiform; head long, compressed, armed above; snout protruding much beyond the small, inferior, U-shaped mouth; teeth

very small, in villiform bands; none on vomer or palatines; lower parts of head with barbels; gill-membranes united to the isthmus, not forming a fold across it. Plates of body armed with spines; spinous dorsal present. Ventral rays I, 2. (*πους*, foot; *θηκη*, box, from a supposed groove for the reception of the ventrals.)

1119. P. vulsus J. & G.

Dark brown, with 7 to 9 darker cross-bars, extending on the fins; pectorals black, with whitish edging and a pale blotch near base; other fins chiefly black, the anal with whitish edging; belly white. Body very elongate, broader than high. Head triangular, the profile irregular, the snout pointed. Mouth ∩-shaped, entirely inferior, the maxillary reaching front of pupil; distance from premaxillaries to tip of rostral spines, about half length of snout; maxillary, interopercle, and branchiostegals, with scattered cirri, these fewer and smaller than in *P. acipenserinus;* none on lower side of snout. Eye large, as long as snout, $3\frac{1}{2}$ in head; the orbital rim prominent all around. Spines of head more numerous than in the other *Agonidæ.* Snout with two strong spines directed forwards, two large ones behind them directed upwards, then two smaller ones; orbital ridge elevated and serrated, with a preocular and a supraocular spine; behind the latter, a ridge armed with two spines on each side, separated from the first plates of the dorsal series by a deep quadrangular pit; a row of minute, erect spines on median line of back and top of head; a sharp, serrated, temporal ridge, with four spines; opercle with a strong rib and several spines; suborbital stay with an irregular prominent ridge; preopercle with three principal spines and some smaller ones; suborbital narrow, half width of eye, extremely uneven, armed with small spines and tubercles; more than 70 spines and tubercles on the head. Plates of body all striate, those above and on sides ending each in a sharp spine; breast with about six polygonal plates, on each side of which are the plates of the abdominal series; bases of caudal and pectorals with small spines. Ventrals short, the vent near the middle of their length. Head 4; depth 8. D. IX–7; A. 9; Lat. l. 40. L. $4\frac{1}{2}$ inches. Deep water, off San Francisco; not common.

(*Agonus vulsus* Jordan & Gilbert, Proc. U. S. Nat. Mus. iii, 303, 1880.)

1120. P. acipenserinus (Tiles.) Gill.—*Alligator fish.*

Brown with darker marblings and narrow vertical streaks; fins olivaceous, more or less marbled with dark; ventrals plain, black in ♂; a

dark bar at base of pectorals; belly white. Body elongate, the tail very slender, broader than deep; head narrow, the cheeks subvertical, the snout long and pointed; mouth ∩-shaped, wholly inferior; distance from premaxillaries to tip of nasal spines less than half snout; maxillary and lower side of snout with dense tufts of long cirri as long as eye; a few on mandible, none on branchiostegal region. Eye large, shorter than snout, 4 in head; orbital rim prominent above only; snout with two spines directed forward, then two larger ones hooked backward, far behind which are two smaller ones close together, directed upward; orbital bones rugose, with a strong supraocular spine only; behind it a sharp occipital ridge on each side, each ending in a single spine; no pit at the occiput, the vertex nearly plane; opercle and preopercle strongly striate, the latter with a ridge and a blunt spine; suborbital very broad, nearly as deep as eye, striate, with a double ridge at its lower margin, the upper ridge with two or three spines; head with about 18 distinct spines in all. Plates of body strongly striate, those above ending in strong spines; breast with about twelve polygonal plates; slight asperities at base of pectoral; ventrals very short, not longer than eye in ♀, about half longer than eye in ♂; pectorals large, about reaching anal; caudal peduncle long, about half length of body without head; dorsals high in ♂, the two fins closely contiguous. Head $3\frac{2}{3}$; depth 6. D. IX–7; A. 8; Lat. l. 37; vert. 12 + 27. L. 12 inches. Puget Sound to Alaska; common northward.

(*Agonus acipenserinus* Tilesius, Mém. Acad. St. Petersb. iv, 422, 1813. *Agonus acipenserinus* Günther, ii, 212: *Podothecus peristethus* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 260: *Paragonus acipenserinus* Gill, l. c. 167: *Agonus acipenserinus* Jordan & Gilbert, Proc. U. S. Nat. Mus. iii, 332, 1880.)

Family CVIII (*b*).—TRIGLIDÆ.*

(*The Gurnards.*)

Body elongate, usually more or less fusiform, covered with scales or series of bony plates. Head externally bony, usually entirely cuirassed with rough, bony plates, some of which are armed with spines; eyes high; mouth terminal or subinferior; premaxillaries protractile; maxillary without supplemental bone, slipping under the preorbital; teeth very small, in bands in the jaws, and usually on the vomer and palatines, sometimes entirely wanting; gills 4, a large slit behind the fourth; pseudobranchiæ present; gill-rakers various; gill-membranes

* Family 108 (*a*), *Agonidæ* is included under *Triglidæ*, in the key to families, on page 79.

free, or variously attached to the isthmus. Ventral fins thoracic, usually wide apart, separated by a flat area, I, 4 or I, 5. Spinous dorsal present, short; soft dorsal similar to the anal, which is without spines; caudal narrow, few-rayed. Pectorals large, with broad base, sometimes divided into two portions, sometimes with the two or three lowermost rays detached. Air-bladder present; pyloric cœca usually present, few in number. Singular looking fishes, allied to the *Cottidæ*, found in all seas. Genera 5; species about 40.

(*Triglidæ* pt. Günther, ii, 191–210, 216–224.)

a. Pectoral fins, with two or three detached appendages below; ventrals I, 5, wide apart.

b. Body mailed; teeth none; pectoral appendages 2. (*Peristediinæ.*)
PERISTEDIUM, 388.

bb. Body scaly; teeth present; pectoral appendages 3. (*Triglinæ.*)

c. Palatines toothless ..... TRIGLA, 389.

cc. Palatines with teeth ..... PRIONOTUS, 390.

aa. Pectoral fin divided to the base, into two unequal parts; ventrals I, 4, contiguous; gill-membranes broadly attached to the isthmus. (*Dactylopterinæ.*)
CEPHALACANTHUS, 391.

388.—PERISTEDIUM Lacépède.

(*Peristedion* Lacépède, Hist. Nat. Poiss. iii, 368, 1802: type *Peristedion malarmat* Lac. = *Trigla cataphracta* Gmelin.)

Body elongate, fusiform, covered with bony plates, each of which is armed with a strong spine; head bony; each preorbital produced into a long flat process, which projects more or less beyond the mouth; mouth small; teeth none; lower jaw included, provided with barbels; gill-membranes separate, narrowly joined to the isthmus anteriorly; gill-rakers slender. Dorsal fin continuous or divided. Pectoral fin short, with the two lowermost rays detached. Ventrals I, 5, separated by a broad flat area. Air-bladder simple. Pyloric cœca about 10. Warm seas. Color generally red. (περι, around; στεθιον, diminutive of στεθος, breast; the breast being mailed.)

1121. P. miniatum Goode.

Bright crimson. Armature of body essentially as in *P. brevirostre;** spines of abdominal plates very weak posteriorly; length of preorbital process 3½ in distance from its extremity to front of orbit; interorbital space deeply concave; protuberance on the forehead very slight; a pair of spines on upper surface of snout behind base of preorbital processes; a larger pair on preorbital processes; ridge of preopercle ending in a depressed, short, sharp-pointed spine; about ten small

* See Günther, Cat. Fish. Brit. Mus. ii, 218, 1860.

tentacles on each side of lower jaw, those near the symphysis smallest. Long tentacles at angle of mouth fringed, extending to bases of pectorals. Head 2½; depth 5. D. VII–18; A. 17; C. 16; P. 2–10; V. I, 5; Lat. l. 28. L. 12 inches. Gulf Stream, off the coast of Rhode Island. (*Goode.*)

(Goode, Proc. U. S. Nat. Mus. 1880, 349.)

389.—TRIGLA Linnæus.

Gurnards.

(Artedi; Linnæus, Syst. Naturæ, 1758: type, *Trigla lyra* L.)

This genus differs from *Prionotus* chiefly in the absence of palatine teeth. The scales are smaller and the pectoral fins less developed; a series of bony, spinous plates extend along the base of the dorsal fins, a pair of them to each ray, the fin thus running in a shallow groove; caudal fin usually emarginate. Lateral line usually forking at base of caudal, the branches running to tip of fin. The numerous species abound on the coasts of Europe, Africa and India. (τριγλα, classical name of *Mullus barbatus;* transferred to this group for no evident reason.)

1122. T. cuculus Linn.—*Red Gurnard.*

Rose-red; profile of snout rather steep, slightly concave; preorbital with short denticulations; maxillary nearly reaching front of orbit; lateral line with a series of unarmed plates, which are deeper than long; first dorsal spine tuberculated; second longest, ⅔ length of head; pectoral reaching past front of anal. Head 3½; depth 5. D. IX–18; A. 17; Lat. l. 75. Common in Europe; said by Cuvier to have been once brought from New York by Milbert.

(Linn. Syst. Nat.: *Trigla pini* Günther, ii, 199; Day, Fish. Gt. Brit. 1880, 58.)

390.—PRIONOTUS Lacépède.

Sea Robins.

(Lacépède, Hist. Nat. Poiss. iii, 337, 1802: type *Trigla evolans* L.)

Body subfusiform; profile of head descending to the broad depressed snout, which is much longer than the small eye; eyes close together, high up; surface of head entirely bony, the bones rough with ridges and granulations; scales on head few or none; preopercle with one or two sharp spines at its angle; opercle with a sharp spine; nape with two strong spines; a spine on shoulder girdle. Mouth rather broad; bands of small, almost granular, teeth on jaws, vomer and palatines; gill-

membranes nearly separate, free from isthmus; gill-rakers rather long. Body covered with small, rough scales, which are not keeled; lateral line continuous; scales of breast very small. Dorsal fins distinct, the first of 8 to 10 rather stout spines; anal fin similar to soft dorsal; pectoral fin with the three lower anterior rays thickened, entirely free from each other and from the fin; ventrals I, 5, wide apart, with a flat space between them, the inner rays longest. Pyloric cœca in moderate number; air-bladder generally with lateral muscles, and divided into two lateral parts; vertebræ 10 or 11 + 15. Species about 10, representing in America the old world genus *Trigla*. (*πριων*, saw; *νῶτος*, back; three free, saw-like spines being said to intervene between the two dorsals.)

a. Mouth small, mandible not reaching vertical from front of orbit; preopercular spine without conspicuous basal cusp; blotches on spinous dorsal well defined, ocellated; a transverse groove connecting the upper posterior angles of orbit. (*Ornichthys** Sw.)

b. Body very slender; sides with numerous round brownish spots.

1123. P. punctatus (Bloch) Cuv. & Val.

Dark olive brown, back and sides covered with numerous round bronze spots, larger than the pupil; spinous dorsal dusky, with lighter streaks and two black ocellated spots; second dorsal and upper half of caudal spotted; anal blackish, with a pinkish border; pectorals blackish, the free rays barred with light and dark; ventrals pale; branchiostegal membrane pinkish. Pectorals short, reaching only to middle of soft dorsal, $2\frac{1}{3}$ in length to base of caudal; first dorsal high. Body much slenderer than in any of the other species. Band of palatine teeth very slender, shorter than eye; maxillary one-third length of head; preorbital without spines; opercle scaleless; gill-rakers shortish; about 10 below angle. Head $3\frac{1}{4}$; depth 6. D. X–13; A. 12; Lat. l. about 75. West Indies, north to North Carolina; not rare southward. Here described from specimens from North Carolina, perhaps belonging to a species distinct from the true *punctatus*, which is described as less slender.

(? *Trigla punctata* Bloch, Ausl. Fisch. taf. 352; ? Cuv. & Val. iv, 93; ? Günther, ii, 193; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 373.)

bb. Body rather robust; sides of body without conspicuous spots.

1124. P. palmipes (Mitch.) Storer.

Brownish above, clouded with darker; throat and branchiostegals dark; a distinct black blotch above on membrane between fourth and

* Swainson, Class. Fish. etc., 1839, 262: type *Trigla punctata* Bloch. (*ορνις*, bird; *ἰχθύς*, fish.)

fifth dorsal spines, this ocellated below; 2 longitudinal light streaks below dorsal blotch; second dorsal with oblique whitish streaks. Head comparatively smooth above. Preopercular spine strong; opercle scaleless; band of palatine teeth short and broad, shorter than eye. Pectorals short, not reaching middle of second dorsal, $2\frac{1}{3}$ in length; pectoral appendages strong, more or less dilated at their tips; ventrals long, reaching anal; gill-rakers rather short, about 10 below angle; maxillary $3\frac{1}{3}$ in head. Head 3; depth 5. D. X–13; A. 12; Lat. l. 58. Atlantic coast of the United States; common northward.

(?? *Trigla carolina* Linnæus, Mantissa, ii, 528: *Trigla palmipes* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 431, 1815: *Prionotus pilatus* Storer, Proc. Bost. Soc. Nat. Hist. ii, 77: *Prionotus palmipes* and *P. pilatus* Storer, Fish. Mass. 18: *Prionotus carolinus* C. & V. iv, 90: *Prionotus carolinus* Günther, ii, 192.)

aa. Mouth large, mandible reaching at least the vertical from front of orbit; no distinct transverse groove between and behind the eyes; preopercular spine with a smaller one at base; dorsal blotch diffuse, not ocellated. (*Prionotus.*)

1125. P. tribulus Cuv. & Val.

Dark brown above, with darker blotches and numerous small, pale spots; belly pale; a black blotch at base of mandible; membrane of spinous dorsal, between the third and sixth spines, with a black blotch above; second dorsal with brownish spots, forming oblique bars, and with 2 dark blotches at base, the posterior blotch continued obliquely downwards and forwards to below the lateral line; pectoral olive brown, with dark cross-bars, which are more distinct towards the tip of the fin; its upper edge white; pectoral appendages with dark spots; basal half of caudal paler. Pectorals rather short, not reaching end of dorsal, 2 in length to base of caudal; pectoral appendages thick, tapering. Body robust. Head shorter and broader, snout shorter, and bones more strongly striate than in *P. evolans;* interorbital space deeply concave; occipital and supraorbital spines very strong and much compressed; band of palatine teeth as long as eye; gill-rakers shortish, 9 below angle; membranous edge of opercle scaly. Head $2\frac{1}{2}$ in length; depth 4. D. X–12; A. 11; Lat. l. about 50. South Atlantic coast of the United States; abundant.

(Cuv. & Val. iv, 98, 1829; Günther, ii, 195; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 374.)

1126. P. evolans (Linn.) Gill.

Similar to var. *lineatus*, but spotted also with white; the pectorals plain black, with pale edgings above, longer than in var. *lineatus*, reaching usually past the end of the second dorsal and anal, $1\frac{1}{2}$–$1\frac{3}{4}$ in

length to base of caudal. Body and head stouter, the plates rougher; scales somewhat larger, in about 55 series. Atlantic coast; common southward.

(? *Trigla evolans* L. Syst. Nat.; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 374.)

Subsp. **lineatus** (Mitch.) J. & G.

Olive brown above, mottled and spotted with blackish; whitish below; a narrow dark streak along the lateral line, with a broader one below it, which terminates behind in a series of spots and blotches; lower jaw and branchiostegal membranes sometimes bright orange-yellow; pectorals blackish, edged with olivaceous and orange, with numerous transverse dark lines; membrane of spinous dorsal with a black blotch between third and sixth spines; soft dorsal plain or with 2 black blotches at base; ventrals and anal orange; pectoral appendages slender, dusky. Gill-rakers rather long and slender, 15 below angle; band of palatine teeth wide, shorter than eye; spines on head moderate in size, compressed, the one at upper posterior angle of orbit little developed; membranous edge of opercle scaly; ventral reaching to front of anal; pectoral reaching to past middle of soft dorsal and anal, from $1\frac{7}{8}$ to $2\frac{1}{4}$ in length. Head $2\frac{2}{3}$ in length; depth $4\frac{1}{2}$. Eye $2\frac{1}{2}$ in snout. D. X–12; A. 11; Lat. l. about 60. Cape Cod to Cape Hatteras; common northward. Perhaps a distinct species, but seeming to vary into the preceding.

(*Trigla lineata* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 430, 1815: *Prionotus lineatus* Storer, Hist. Fish. Mass.: *Prionotus lineatus* Günther, ii, 192: *Prionotus strigatus* Cuv. & Val. iv, 86.)

1127. P. stephanophrys Lockington.

Pale olivaceous, abruptly white at level of pectorals; back and sides with a few scattered dark spots; branchiostegals mostly saffron-yellow; spinous dorsal dusky, with a diffuse dark blotch between fourth and fifth spines, near edge of membrane; second dorsal spotted; caudal with dark blotches; pectorals dark, with large round black spots. Body rather stout; head large, compressed, broad, and very nearly plane above; the interorbital region not concave; no transverse furrow behind orbits; orbital rim with a slightly raised, serrated crest; snout very short, two-fifths length of head; mouth large, the broad maxillary reaching beyond front of orbit; bands of palatine teeth very narrow; gill-rakers long and slender; head less rough than usual, the bones little striate; occipital processes not reaching first dorsal spine; preorbital little projecting; preopercle with a strong smooth spine,

reaching slightly beyond membrane of opercle; opercle ending in two points, the lower a long spine, the membrane connecting the two scaly; scales thin, ciliate, not closely imbricate; first dorsal spine granulate in front; pectorals reaching beyond middle of anal, about to base of ninth ray; free rays very slender, the uppermost more than half length of fin; ventrals not reaching vent; caudal slightly emarginate. Head $2\frac{2}{3}$; depth 4; eye $1\frac{1}{3}$ in snout. D. X–12; A. 11; P. 13–III; Lat. l. 55. Deep water off San Francisco; one specimen known.

(Lockington, Proc. U. S. Nat. Mus. 1880, 529.)

391.—CEPHALACANTHUS Lacépède.

Flying Gurnards.

(*Dactylopterus* Lacépède, iii, 325.)

(Lacépède, Hist. Nat. Poiss. iii. 323, 1802: type *Gasterosteus spinarella* Linn.)

Body elongate, subquadrangular, tapering behind; head very blunt, quadrangular, its surface almost entirely bony; nasals, preorbitals, suborbitals, and bones of top of head united into a shield; nuchal part of shield on each side produced backward in a bony ridge, ending in a a strong spine, which reaches past front of dorsal; interocular space deeply concave; preorbitals forming a projecting roof above the jaws; preopercle produced in a very long rough spine; cheeks and opercles with small scales; opercle smaller than eye; gill-openings narrow, vertical, separated by a very broad, scaly isthmus; pseudobranchiæ large; gill-rakers minute; mouth small, lower jaw included; jaws with granular teeth; no teeth on vomer or palatines; scales bony, strongly keeled; 2 serrated, knife-like appendages at base of tail; first dorsal of 4 or 5 rather high flexible spines, the first one or two spines nearly free from the others; an immovable spine between the dorsals; anal and second dorsal short, of slender rays; caudal small, lunate; pectoral fins divided to the base into two parts, the anterior portion (corresponding to the free rays in *Prionotus*) about as long as the head, of about 6 rays, closely connected; the posterior and larger portion more than twice length of head, reaching nearly to caudal in the adult ("*Dactylopterus*" Lac.); much shorter in the young ("*Cephalacanthus*" Lac.); these rays very slender, simple, wide apart at tip; ventrals I, 4, long, pointed, their bases close together, the inner rays shortest; air-bladder with two lateral parts, each with a large muscle; pyloric cœca numerous; vertebræ 9 + 13. Warm seas; the adult able to move

in the air, like the true flying-fish, but for shorter distances. (*κεφαλη*, head; *ακανθα*, spine.)

a. Occiput without filament.

1128. C. spinarella (L.) Lac.—*Flying-robin; Bat-fish; Volador.*

Greenish olive and brown above, of varying shades; below pale, marked irregularly with dusky and bright brick-red, varying to salmon-yellow; pectoral fins mottled with bright blue streaks near the base, and blue spots and bars toward the tip; their under sides glaucous-blue, edged with darker; caudal fin with about three brownish-red bars; coloration extremely variable. First two dorsal spines free, slightly connected by membrane at base; preopercular spine reaching beyond base of pectorals, not to end of occipital spine; pectorals reaching nearly to base of caudal. Head $4\frac{1}{3}$; depth $5\frac{1}{2}$. D. II–IV, 8; A. 6; P. 28, 6. L. 12 inches. Atlantic Ocean, on both coasts; abundant southward.

(*Gasterosteus spinarella* L. Syst. Nat. i, 492 (young): *Trigla volitans* Linn. Syst. Nat. i, 498 (adult): *Trigla volitans* Gmelin, Syst. Nat. 1788, 1346: *Dactylopterus volitans* Günther, ii, 221: *Dactylopterus volitans* Lütken Spolia Atlantica, 1880, 417; Günther, ii, 224.)

Family CIX.—LIPARIDIDÆ.

(*The Sea Snails.*)

Body more or less elongate, subcylindrical anteriorly, compressed behind, covered with smooth skin, which is usually very lax. Head broad, obtuse, the snout short; suborbital bone styliform behind, joined to the preopercle, as in the *Cottidæ;* jaws with bands of small teeth, which are usually tricuspid; no teeth on vomer or palatines; premaxillaries protractile, little movable; opercular bones unarmed; interopercle slender, ray-like, overlying the branchiostegals; gill-openings small, the membranes joined to the broad isthmus, and to the humeral arch below. Gills $3\frac{1}{2}$; no slit behind the last; pseudobranchiæ rudimentary or wanting; pyloric cœca numerous; no air-bladder; dorsal fin rather long, the spines feeble and flexible, low, similar to the soft rays; anal long, similar to the soft dorsal; ventral fins I, 5, the two completely united, and forming the bony center of an oval sucking-disk; ventrals sometimes entirely wanting; pectoral fins very broad, the base procurrent; the outline usually emarginate, some of the lower rays being produced; tail diphycercal; caudal fin short, convex; vertebræ 12 + 30. Genera 3; species about 20. Small fishes, nearly all of the northern seas.

(*Discoboli;* group *Liparidina* Günther, iii, 158–165.)

a. Ventral disk entirely wanting. (*Amitrinæ.*)
b. Lower jaw included; skin thin, lax.....AMITRA, 392.
aa. Ventral disk present. (*Liparinæ.*)
c. Ventral disk very small, under the head, the vent close behind it; lower jaw projecting; skin lax, thin.....CAREPROCTUS, 393.
cc. Ventral disk well developed; vent well behind head.....LIPARIS, 394.

392.—AMITRA Goode.

(Goode, Proc. U. S. Nat. Mus. 1880, 478: type *Amitra liparina* Goode.)

Body elongate, attenuate backward, covered with lax, smooth, slimy skin, which is separated from the body and fins by a filmy mucous intertissue. Head small, thick, convex between eyes; snout convex, protruding; mouth small, horizontal, the lower jaw included; teeth small; eyes lateral; gill-openings restricted to small slits above the base of the pectorals, covered by the very small opercle; no barbels; dorsal and anal fins many-rayed; dorsal continuous, almost concealed by the skin; the spines scarcely different from the soft rays; anal similar to dorsal; both connected with the caudal, which is pointed; no trace of ventral fins or sucking disk; pectoral fin very broad, procurrent, its lower rays inserted nearly under the eye, the fin emarginate; vent well behind head. One species known; its position intermediate between the *Cottidæ* (*Cottunculus*, *Psychrolutes*) and *Liparididæ*, two groups much more intimately related than most writers have conceded.* (*a*, without; *μιτρα*, stomacher.)

1129. A. liparina Goode.

Yellowish white, dusky toward the tail and front of head; peritoneum black. Body posteriorly compressed, the tail very thin; eyes half width of interorbital space, 5 in head; upper lip with pores. Dor-

*I should put the family of *Gobiesocidæ* far away, at least a suborder off, from the *Cyclopteridæ* and *Liparididæ*, which are far more closely united to the true *Cottidæ*, represented by *Cottus* and *Hemitripterus*, than to either the *Gobiesocidæ* proper or to the Gobies and Blennies. In fact, *Liparis* has as close affinities, as shown by its skeleton, with *Cottus* and *Hemitripterus* as with *Cyclopterus;* and we have in the three groups, represented by *Cottus*, *Liparis*, and *Cyclopterus*, well-marked families of the same suborder. The only character by which the *Cyclopteridæ* and *Liparididæ* are closely united consists in the peculiar formation of the ventral disk by the union of the ventral fins; but as this structure is simply brought about by the modification of the rays in a manner common to the several genera, and not by any marked anatomical difference in the structure of the same fins in *Cottus*, I can only look upon it as a generic character common to the known representatives of both families of *Cyclopteridæ* and *Liparididæ;* and the discovery of a representative of either family with ventral fins of the ordinary form would not necessitate the establishment of a family for its reception, as in that case we should simply consider the structure as of generic value. (Putnam, Proc. Am. Ass. Adv. Sci. 1873, 337.)

sal beginning over pectoral; anal under ninth dorsal ray. Head $6\frac{2}{3}$; depth $5\frac{1}{2}$. D. V, 62; A. 54; C. 6; P. 23. L. 5 inches. Deep water off the coast of Rhode Island; lately dredged by the U. S. Fish Commission.

(Goode, Proc. U. S. Nat. Mus. 1880, 478.)

393.—CAREPROCTUS Kröyer.

(Kröyer, Naturh. Tidsskr. i, 257, 1862: type *Liparis reinhardi* Kröyer.)

Body elongate, semi-transparent, covered with thin lax skin; mouth oblique, the lower jaw projecting; teeth simple, hooked; ventral disk small, situated far forwards, under front of eye; vent a little behind it, far in front of anal fin. (*καρα*, head; *πρωκτός*, vent.)

1130. C. gelatinosus (Pallas) Kröyer.

Rose-colored; vertical fins violet; gill-cavity black. Ventral disk very small, supported by a bilamellate cartilage descending from the throat; vertical fins continuous. Body oblong, compressed, semi-transparent, soft, and gelatinous; head thick, flat above; cleft of mouth nearly vertical, as in *Uranoscopus;* a series of pores along upper lip; jaws, palate, and pharynx rough with teeth; skeleton very weak. D. more than 50; A. about 45; C. 6; P. 30; cœca 48; vertebræ 64. (*Günther.*) Alaska and Kamtschatka; Greenland.

(*Cyclopterus gelatinosus* Pallas, Spicilegia, vii, 19, 1769: *Liparis gelatinosus* Günther, iii, 163? ?*Liparis gelatinosus* Reinh. Oversigt, &c. 1844, lxxvii: ?*Liparis reinhardi* Kröyer, Naturh. Tidsskr. i, 252: ?*Careproctus reinhardi* Kröyer, l. c., 257, the Greenland form, thought by Dr. Kröyer to be different from *C. gelatinosus.*)

391.—LIPARIS Linnæus.

Sea-Snails.

(Artedi; Linnæus, Syst. Nat.: type *Cyclopterus liparis* L.)

Body rather elongate, covered with smooth skin, which is usually freely movable; head short, flattened above; mouth horizontal, the lower jaw included; teeth in several series, usually tricuspid; maxillary covered by skin of preorbital region; ventral disk well developed, on the breast, its front below or behind the middle of the head; vent well behind the head, about midway between sucking-disk and anal fin. Dorsal fin continuous or divided, its spines hardly differentiated; dorsal fin free from caudal or not; pectoral emarginate, some of the lower rays produced; vertical fins enveloped in skin. Northern seas (one species known from Chili). (*λῖπᾰρός*, sleek-skinned, shining.)

a. Dorsal fin continuous. (*Liparis.*)

b. Dorsal fin connected with the caudal.

1131. L. major (Walb.) Gill.

Dorsal and anal slightly connected with base of caudal; anterior nostrils tubular; posterior simple. D. 45; A. 38; P. 42; C. 10. Size very large. L. 10 inches. Greenland. (*Gill.*)

(*Cyclopterus liparis* var. *major*, Walb. Artedi Pisc. 489, 1792: *Liparis tunicata* Kröyer, Naturh. Tidsskr. i, 236, 1862: *Actinochir major* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 193.)

1132. L. pulchella Ayres.

Grayish, usually with wavy purplish stripes, sometimes marbled and spotted with purplish; pectorals spotted or banded with grayish purple; lateral line with round whitish spots. Snout broad and blunt, projecting beyond mouth; maxillary reaching nearly to front of eye; teeth short, close-set, a broad band in each jaw, that of upper jaw broadest. Body compressed behind, thick in front; head almost globular; anterior nostrils tubular; skin very thin and lax. Dorsal fin high, undivided, continuous with anal and caudal around the tail; tail tapering to a point, appearing isocercal, but the vertebræ essentially as in other species; pectorals very broad, the base of lowermost rays under eye; ventral disk small, oval, $2\frac{1}{2}$ in head; pseudobranchiæ well developed. Head 5; depth 5. D. 48; A. 39; C. 12; P. 36. L. 10 inches. Pacific Coast, from Monterey to Puget Sound; not rare.

(Ayres, Proc. Cal. Acad. Nat. Sci. i, 1855, 23; Günther, iii, 164; Steindachner, Ichth. Beiträge, iii, 53, 1875.)

1133. L. gibba Bean.

Head and body very pale brown or gray, paler below; head and anterior parts often with concentric brown rings; sides plain or marked with brown stripes and rings; tail sometimes with dark blotches; vertical fins usually with dark bands. Body abruptly contracted near the vent, covered with lax skin; interorbital space shallow-concave, the vertex and nape somewhat elevated; snout depressed; head as wide as long, longer than deep; nostrils tubular, the tubes of anterior nostrils longest; eye small, 4 in head; ventral disk nearly circular, 8 in length; vertical fins confluent; dorsal continuous; longest dorsal ray half as long as head; pectorals reaching front of anal; caudal 6 in body. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. 42; A. 36; P. 35; C. 12. Bering's Sea, Alaska and Siberia. "Distinguished from *L. fabricii* by its smaller eye and its depressed snout," and from "*L. tunicata*" by the larger eye and fewer rays in dorsal, anal, and pectorals. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. iv, 148, 1881.)

1134. L. arctica Gill.

Uniform dark rusty-brown or chestnut. Snout rather high and decurved; interorbital space 3 in head; forehead depressed; anterior nostrils simple, posterior tubular. Vertical fins confluent; caudal convex, 7 in total length; pectoral $5\frac{1}{3}$; ventral disk 10. Head 4 in total, its width $6\frac{1}{2}$; depth $2\frac{3}{4}$. D. 42; A. 34; C. 11; P. 35. Port Foulke, Greenland. (*Gill.*)

(Gill, Proc. Acad. Nat. Sci. Phila. 1864, 191.)

1135. L. tunicata Reinh.

Yellowish, mottled with brownish. Eye nearly 3 in snout or interorbital space; posterior nostril not tubular; pseudobranchiæ reduced to two lamellæ; vertical fins continuous; anal beginning below tenth dorsal ray; ventral disk longer than broad, half length of head; skin thin, loose. D. 42; A. 34; C. 12; P. 34. Coasts of Greenland. (*Günther.*)

(*Liparis tunicata* Reinhardt, Overs. Kong. Danske Vidensk. Selsk. vi, cxi, 1836, "D. 39; A. 33; P. 30; C. 14": *Liparis fabricii* Kröyer, Naturh. Tidsskr. ii, 274, 1847: *Liparis fabricii* Günther, iii, 161: *Liparis fabricii* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 192.)

1136. L. lineata (Lepechin) Kröyer.

Yellowish, striped with dark brown or purplish; the color very variable. Body thick, covered with thin, loose, slippery skin; head obtuse, the nape swollen; snout broad, not depressed; lips thickish; posterior nostril tubular; eye 7 in head; gill-openings reduced to a vertical slit extending to upper part of root of pectoral; pseudobranchiæ obsolete; tail truncate at base of caudal. Dorsal and anal fins united with the caudal; ventral disk rather longer than broad, half length of head, its margin with about 13 papillæ. Head 4; depth $3\frac{1}{2}$. D. 33; A. 28; P. 34; C. 13. L. 5 inches. Northern Europe and America, south to Cape Cod.

(*Cyclopterus liparis* L. Syst. Nat. i, 414: *Cyclopterus lineatus* Lepechin, Nov. Comm. Petropol. xviii, 522: *Liparis vulgaris* Günther, ii, 159; Lütken, Naturh. Foren. Vidensk. Meddels. 1860 and 1861, 243; Collett, Norges Fiske, 1875, 65.)

1137. L. ramula Goode & Bean.

Color uniform whitish, translucent in life. Body thick, subcylindrical anteriorly, rapidly tapering to the tail; skin thick, lax; snout broad, with prominent vertical profile, its length 4 in head; maxillary 3 in head, not reaching front of orbit; ventral disk nearly round, its length half its distance from snout. Head 4; depth 4. Pectoral 5.

D. about 48; A. about 48; P. 27; V. 14 (papillæ). (*Goode & Bean.*) Halifax.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 46.)

bb. Dorsal separated from caudal by a notch.

1138. L. montagui (Donov.) Cuv.

Yellowish, the vertical fins brighter, with darker margins. Trunk thick; head broad; skin thin, loose; head flat above the nape, slightly prominent; snout very broad; maxillary not reaching eye; posterior nostrils simple; eye 9 in head, half length of snout or interorbital space; pseudobranchiæ none; posterior nostril not tubular; pectorals notched; dorsal continuous, not joined to the caudal; anal not connected with caudal; ventral disk circular, not quite half as long as head. Head 4 in total length; depth 5. D. 28; A. 24; C. 14; P. 30; vert. 10 + 25. (*Günther.*) Massachusetts to Greenland and Northern Europe; not rare.

(*Cyclopterus montagui* Donovan, British Fishes, iii, pl. 68; Günther, iii, 161: Collett, Norges Fiske, 1875, 67.)

1139. L. calliodon (Pallas) Gthr.

Olivaceous, punctate with black dots, light below. Body depressed forwards, compressed and tapering behind; head narrowed forwards; snout rounded; eye small; interorbital space broad and nearly flat; maxillary not reaching eye; teeth small, evidently tricuspid, in broad bands; skin lax, thickish. Gill-openings very small. Dorsal and anal barely joined to base of caudal rays; edge of disk with 12 papillæ; diameter of disk about one-half length of head. D. 28; A. 26. Alaska; abundant.

(*Cyclopterus callyodon* Pallas, Zoogr. Ross.-Asiat. iii, 75, 1811; Günther, iii, 162.)

1140. L. cyclopus Gthr.

Reddish olive, with darker specks, most conspicuous on the fins; a dark bar at base of caudal; a dark streak below eye; a pale streak along sides. Skin not very thick, adherent. Body everywhere compressed, even the head being deeper than broad; head scarcely convex above, the nape not prominent; jaws equal; maxillary reaching to opposite middle of the small eye; teeth small, three-lobed; ventral disk oval, three-fifths length of head. Dorsal fin scarcely emarginate, the spines rather stiff, the first spine in front of vent; pectorals reaching vent; caudal entirely free from dorsal and anal. Head 4; depth 5. D. VII, 23; A. 27; C. 12. Monterey to Puget Sound. (Here described

from a small example taken at Monterey, perhaps belonging to a different species.)

(? *Liparis cyclopus** Günther, ii, 163, 1861.)

aa. Dorsal fin emarginate, the spines separated from the soft rays; skin firm. (*Neoliparis*† Steind.)

1141. L. mucosa Ayres.

Rose-red or brownish, unspotted. Body strongly compressed, the back somewhat elevated, not much depressed forwards, the head not wider than deep, longer than in *L. pulchella;* mouth rather large, terminal, the jaws equal when closed; teeth bluntly tricuspid, the band in upper jaw widest; eyes small; skin firm, thick, little movable. Dorsal fin separated into two parts by a deep emargination; second dorsal rather low, entirely free from caudal; anal nearly free from caudal; pectorals moderate; ventral disk oval, $2\frac{1}{2}$ in head; vent at posterior fourth of pectorals; end of tail truncate. Head $4\frac{1}{4}$; depth about 4. D. VII, 26; A. 26; C. 16; P. 31. L. 6 inches. Coast of California; rare.

(*Liparis mucosus* Ayres, Proc. Cal. Acad. Nat. Sci. i, 24, 1855: *Liparis mucosus* Günther, iii, 559; Steindachner, Ichth. Beiträge, iii, 54, 1875.)

Family CX—CYCLOPTERIDÆ.

(*The Lump Suckers.*)

Body short and thick, more or less elevated, covered with a thick skin, which is smooth, tubercular, or spinous; head short and thick; suborbital stay present, thin and flattish; mouth small, terminal; jaws with bands of slender teeth; no teeth on vomer or palatines; gill-openings narrow, restricted to the sides, the membranes being broadly joined to the isthmus and shoulder girdle; branchiostegals 6; dorsal fin long, the anterior part of flexible spines, which, in the adult, are sometimes hidden by a fleshy hump, sometimes entirely wanting; soft dorsal small, opposite the anal, and similar to it; caudal fin rounded, free from the dorsal and anal; ventrals thoracic, rudimentary, forming the bony center of a sucking-disk; pectorals short, placed low,

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* In Dr. Günther's type of *L. cyclopus*, from Esquimault Harbor, the fin-formula is D. 35; A. 30; C. 12; the ventral disk is said to be less than half the length of the head, and the dorsal is said to begin behind the vent. The species is said to agree "in nearly every respect with *L. vulgaris*" (*lineata*). Our specimen is much nearer *L. mucosa*.

† Steindachner, Ichth. Beiträge, iii, 54, 1875: type *Liparis mucosus* Ayres. (νεω, new; *Liparis*.)

their bases broad and procurrent; pyloric cœca numerous; vertebræ 12 + 16, the skeleton feebly ossified. Genera 2; species 4; inhabiting the northern seas of both hemispheres. By means of the adhesive ventral disk these fishes are enabled to attach themselves very firmly to rocks or other objects.

(*Discoboli;* group *Cyclopterina* Günther, iii, 154–158.)

a. Spinous dorsal wanting; skin smooth or nearly so.....CYCLOPTERICHTHYS, 395.
aa. Spinous dorsal present, sometimes disappearing with age; skin tuberculate.
CYCLOPTERUS, 396.

395.—CYCLOPTERICHTHYS Steindachner.

(Steindachner, Ichth. Beiträge, x, 14, 1881: type *Cyclopterichthys glaber* Steind. = *Cyclopterus ventricosus* Pallas.)

Body short and thick, rounded, covered with thick smooth skin, destitute of bony tubercles (or nearly so?); tail slender, compressed, the body abruptly contracted to its base; head broad, obtuse; mouth oblique, the lower jaw prominent; teeth rather small, sharp, in two rows anteriorly; pseudobranchiæ large; gills $3\frac{1}{2}$; suborbital connected by a bony stay with the preopercle; gill-opening small, above the base of the pectoral, which is broad and procurrent; ventral disk moderate, fringed. Dorsal short and high, of soft rays only, opposite the short anal, both well separated from the small caudal. (*κύκλοπτερὸς*, round-finned; *ἰχθύς*, fish.)

1142. C. ventricosus (Steindachner) J. & G.

Brown, with numerous round dark spots. Head broader than long, the greatest depth a little less than its length; eye small, round, 7 in head, the maxillary extending to below its middle. Head 3; depth $2\frac{1}{5}$. D. 9; A. 7; P. 20; C. 11. L. 12 inches. (*Steindachner.*) Okhotsk Sea, northward.

(*Cyclopterus ventricosus* Pallas, Spicilegia Zoöl. vii, 15, t. 2, about 1770: (*Cotylis?*) *ventricosus* Günther, iii, 498: *Cyclopterichthys glaber* Steind. Ichth. Beiträge, x, 14, 1881, taf. viii.)

1143. C. stelleri (Pallas) J. & G.

Color blackish. Body ovate, smooth; a single series of osseous tubercles along the middle of the back to the origin of the dorsal fin; lower jaw longest; teeth small, unequal; eyes small, high; gill-opening reduced to a round foramen. Dorsal fin commencing on the middle of the back and extending to near the base of caudal; anal ending opposite dorsal. Peter and Paul's Harbor, Bering's Sea. (*Pallas.*)

(*Cyclopterus stelleri* Pallas, Zoogr. Ross.-Asiat. iii, 73, 1811: (*Cotylis?*) *stelleri* Günther, iii, 499.)

396.—CYCLOPTERUS Linnæus.

(*Lumpus* Cuvier.)

(Artedi; Linnæus, Syst. Nat.: type *Cyclopterus lumpus* L.)

Spinous dorsal present, sometimes disappearing with age; skin thick, armed with series of bony tubercles; other characters of the genus included above. (κύκλος, circular; πτερόν, fin; from the circular ventral disk.)

a. Dorsal spines not disappearing with age; gill-opening a small slit on level of eye; ventral disk large. (*Eumicrotremus** Gill.)

1144. C. spinosus Müller.

Color olivaceous, the skin between the plates thickly punctate. Body orbicular, cuboid anteriorly; base of spinous dorsal and body behind vent abruptly compressed; teeth in narrow bands; gill-openings on a level with eye, slightly narrower than orbit. Spinous dorsal not hidden, covered with rough tubercles, similar to those on body, but smaller; width of ventral disk slightly less than its length, and somewhat less than length of head. Body covered with irregular roundish conical plates, varying much in size, some of the larger with a central point, turned backward; all the plates with small tubercles and slender flexible prickles; small plates along bases of all the fins; a series of 6 large plates extending backward from above eye to opposite the interval between dorsals; a series of 5 on each side of middle of interocular space from snout to nape, these increasing much in size posteriorly; a series of 3 along opercular margin; along base of spinous dorsal, a series of 4, not connected with that of interorbital space; a single large plate on each side of the interval between dorsals; two longitudinal series of 4 large plates each, beginning above base of pectorals and behind gill-slits, terminating under the space between dorsals; the largest plate on body is immediately behind axil of pectoral; a smaller one below it, and two others between it and origin of anal; two series of smaller plates below eye; many small plates interposed between the series of large ones; very small plates on under side of head and middle of tail; no plates between ventral disk and vent; none in axil of pectorals. Head 3; depth nearly 2. D. VII–11; A. 10; C. 10. Alaska to Iceland, south

* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 190: type *Cyclopterus spinosus* Müll. (ευμικρος, very small; τρῆμα, aperture, from the small gill-openings.)

to Puget Sound and Maine. Here described from an Alaskan specimen of "*C. orbis.*"

(Müller, Prodr. Zoöl. Dan. ix, 1777; Fabricius, Fauna Grœnlandica, 1780, 134; Günther, iii, 157: *Cyclopterus orbis* Günther, iii, 158, 1861, specimen from Vancouvers Island.)

aa. Dorsal spines enveloped in a fleshy hump in adult; gill-openings larger; ventral disk small. (*Cyclopterus.*)

1145. C. lumpus L.—*Lump-Sucker; Lump-fish.*

Olivaceous, with darker markings; skin punctulate. Head heavy, almost round; interorbital space very wide, flattish; maxillary reaching to or slightly beyond front of eye; gill-openings extending from level of upper margin of eye to opposite middle of base of pectorals; length of gill-opening about equal to base of pectoral, three-fifths length of head, equal to length of ventral disk; a fleshy hump on the back, which, in the adult, covers the spinous dorsal; skin with small tubercles, and about 7 rows of larger spinous plates; a median dorsal row, which divides and forms two series behind the hump; two lateral rows, of which the lower has larger plates; one abdominal row on each side. Head $3\frac{1}{4}$; depth 2. D. about VII–10; A. 10. North Atlantic; rather common on the coasts of America and Europe.

(Linnæus, Syst. Nat.; Günther, iii, 155: *Lumpus anglorum* Dekay, N. Y. Fauna, Fish. 305.)

Family CXI—GOBIESOCIDÆ.

Body rather elongate, broad and depressed in front, covered by smooth, naked skin; mouth moderate; upper jaw protractile; teeth usually rather strong, the anterior conical or incisor-like; posterior canines sometimes present; no bony stay from suborbital across cheeks; opercle reduced to a small spine-like projection concealed in the skin, behind angle of the large preopercle; pseudobranchiæ small or wanting; gills 3 or $2\frac{1}{2}$; gill-membranes broadly united, free or united to the isthmus; dorsal fin on the posterior part of the body, opposite to the anal and similar to it, both fins without spines; ventral fins wide apart, each with one concealed spine and 4 or 5 soft rays. Between and behind the ventrals is a large sucking-disk, the ventrals usually forming part of it. This sucking-disk, which is different in structure from that of *Cyclopterus* and *Liparis*, is thus described by Dr. Günther:

"The whole disk is exceedingly large, subcircular, longer than broad, its length being (often) one third of the whole length of the fish. The

central portion is formed merely by skin, which is separated from the pelvic or pubic bones by several layers of muscles. The peripheric portion is divided into an anterior and posterior part by a deep notch behind the ventrals. The anterior peripheric portion is formed by the ventral rays, the membrane between them and a broad fringe, which extends anteriorly from one ventral to the other. This fringe is a fold of the skin, containing on one side the rudimentary ventral spine, but no cartilage. The posterior peripheric portion is suspended on each side on the coracoid, the upper bone of which is exceedingly broad, becoming a free, movable plate behind the pectoral. The lower bone of the coracoid is of a triangular form, and supports a very broad fold of the skin, extending from one side to the other, and containing a cartilage which runs through the whole of that fold. Fine processes of the cartilage are continued into the soft striated margin, in which the disk terminates posteriorly. The face of the disk is coated with a thick epidermis, like the sole of the foot in higher animals. The epidermis is divided into many polygonal plates. There are no such plates between the roots of the ventral fins." (Günther, iii, p. 495.) No air-bladder; intestines short; pyloric cœca few or none; skeleton firm; vertebræ 13 to 14 + 13 to 22. Carnivorous fishes of small size, chiefly of the warm seas, usually living among loose stones between tide-marks and clinging to them firmly by means of the adhesive disk. Genera 10; species 25 to 30.

(*Gobiesocidæ* Günther, iii, 489–515.)

a. Gill-membranes free from the isthmus; gills 3; lower jaw with incisors; posterior part of sucking-disk, without a free anterior margin. . . . . GOBIESOX, 397.

397.—GOBIESOX Lacépède.

(Lacépède, Hist. Nat. des Poiss. ii, 595, 1800: type *Gobiesox cephalus* Lacépède.)

Body anteriorly very broad and depressed, posteriorly slender, covered with tough, smooth skin; head large, rounded in front; mouth terminal, crescent-shaped; lower jaw with a series of strong incisors in front; upper jaw with a narrow band of teeth, those of the anterior series larger; no teeth on vomer or palatines; gills 3; gill-membranes broadly united under the throat, not attached to the isthmus; sucking-disk large, the posterior portion without anterior free margin. Species numerous, all American; mostly tropical. (*Gobius; Esox.*)

a. Anal fin of 10 to 13 rays, about as long as dorsal. (*Caularchus** Gill.)

b. Incisors of lower jaw entire.

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*Gill, Proc. Acad. Nat. Sci. Phila. 1862, 330: type *Lepadogaster reticulatus* Grd. (καυλος, stem; αρχος, anus; *i. e.*, anal many-rayed.)

1146. G. reticulatus (Grd.) J. & G.

Light olive, everywhere reticulated with brownish orange; middle of upper lip black; a light bar between eyes and across cheeks; vertical fins dusky; caudal with two faint brownish bars near its base. Head nearly as broad as long; mouth wide, its width more than half length of head; outer teeth of upper jaw rather strong, close-set, vertical, conical, or slightly compressed, a narrow band of small, conical teeth behind them; lower jaw with larger teeth, 6 or 8 of the anterior broad, incisor-like, with entire edges, placed nearly horizontally; lateral and posterior teeth small, as in upper jaw; distance from vent to caudal $2\frac{3}{4}$ in length of body; sucking-disk as broad as long, $3\frac{1}{2}$ in length. Head $2\frac{3}{4}$; depth $6\frac{1}{2}$. D. 13; A. 12; V. I, 4. L. 6 inches. Puget Sound to Monterey; very abundant in rock-pools.

(*Lepadogaster reticulatus* Grd. Proc. Acad. Nat. Sci. Phila. 1854, 155: *Lepadogaster mæandricus* Grd. U. S. Pac. R. R. Surv. Fish. x, 130: *Gobiesox mæandricus* Günther, iii, 505.)

1147. G. strumosus Cope.

Bluish plumbeous, fins blackish. Head extremely wide, its width $2\frac{5}{6}$ in total length; this width partly produced by a large fleshy mass extending from end of maxillary to end of interopercle; eye small; profile of head descending abruptly from posterior line of orbits. Superior dental series 12 on each side, externally, but the three median teeth conceal some series of which the second three external teeth are a continuation; inferior teeth, 11 on each side; four median incisors horizontal and subequal; no marked canine. D. 11; A. 10; C. 16; P. 21. (*Cope.*) Hilton Head, South Carolina.

(Cope, Proc. Acad. Nat. Sci. Phila. 1870, 121.)

bb. Incisors of lower jaw tricuspid.

1148. G. rhessodon Rosa Smith.

Dark olivaceous, usually with three broad yellowish cross-bands above; the first across interorbital space and cheeks, the second, very wide, across back and front of dorsal fin, the third below middle of dorsal; some or all of these sometimes wanting. Form much as in *G. reticulatus;* distance from vent to caudal $2\frac{2}{5}$ in length of body; maxillary extending to below eye; incisors of lower jaw tricuspid, not much declined, about 8 in number; upper teeth essentially as in *G. reticulatus.* Dorsal a little longer than anal, coterminous with it. Head $3\frac{1}{4}$; depth $6\frac{1}{2}$. D. 11; A. 10. L. $2\frac{1}{2}$ inches. San Diego to the Gulf of California; locally abundant.

(Rosa Smith, Proc. U. S. Nat. Mus. 1881, 140.)

Family CXII.—BATRACHIDÆ.*

(*The Toad-fishes.*)

Body generally robust, depressed anteriorly, compressed behind; head large, depressed, its muciferous channels well developed; mouth very large, the teeth generally strong; premaxillaries protractile; gills 3, a slit behind the last; pseudobranchiæ none; gill-openings restricted to the sides, the membranes broadly united to the isthmus; branchiostegals mostly 6; gill-rakers present, moderate; suborbital without bony stay; post-temporal bone simple, undivided; scales small, cycloid, or wanting. Dorsal fins 2, the first of two or three low, stout spines; soft dorsal very long; anal fin similar, but shorter; ventrals rather large, jugular, I, 2 or I, 3; pectorals very broad, the rays branched; pyloric cœca none; tail diphycercal, the caudal fin distinct, rounded. Carnivorous coast fishes, mostly of the warm seas; the young of some or all the species fasten themselves to rocks by means of an adhesive ventral disk, which soon disappears. Genera 5; species about 12.

(*Batrachidæ* Günther, iii, 166–177.)

a. Body naked.

b. Lateral line obsolete; dorsal spines 3 ..... Batrachus, 398.

bb. Lateral lines several, each formed of shining bodies imbedded in the skin, accompanied by pores and minute cirri; no axillary foramen; dorsal spines 2. Porichthys, 399.

398.—BATRACHUS Bloch & Schneider.

(Klein; Bloch & Schneider, Syst. Ichth. 1801, 42: type *Gadus tau* L.)

Body comparatively short and robust, scaleless; head large, depressed; jaws, vomer, and palatines each with a single series of strong blunt teeth; mandible with an additional external series at symphysis; teeth of upper jaw small; dentary bones forming an acute angle at symphysis; lips fleshy; upper angle of opercle with 2 diverging spines, more or less concealed in the skin; spinous dorsal of 3 stout short spines, the second the longest; no lateral line nor conspicuous pores; young with series of small tufted cirri on back and sides; branchiostegals 6; vertebræ 12 + 22. (βατράχος, a frog.)

a. Axil of pectoral with a large foramen.

1149. B. tau (Linn.) Cuv. & Val.—*Toad-fish; Oyster-fish; Sarpo.*

Dusky olive, with black markings confluent on the sides and forming irregular, indistinct bars; belly and under side of head lighter; fins

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* Family "114" of the key on page 80.

with black bars, those on dorsal and anal oblique. Teeth in mandible small anteriorly, regularly increasing in size backwards; those on vomer prominent; a broad flap above orbit; tip of maxillary and lower side of mandible with conspicuous cirri; a series of smaller cirri along margin of preopercle; subopercle ending in a long, sharp spine; orbit about equalling interorbital width or length of snout; pectoral with a large foramen in the axil. Head $2\frac{2}{3}$; depth $4\frac{1}{3}$. D. III–27; A. 24. Massachusetts to the West Indies; very abundant.

(*Gadus tau* Linn. Syst. Nat.; Günther, iii, 167.)

Subsp. **pardus** Goode & Bean.

Very pale yellowish-brown, thickly covered with round spots of dark brown; those on head smaller; belly with numerous spots, the largest as large as eye; back with many oblong blotches, besides small round spots; fins blotched and banded; otherwise as in *B. tau*. Pensacola, Fla.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 336.)

399.—PORICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 141: type *Porichthys notatus* Grd. = *Batrachus porosissimus* C. & V.)

Body rather elongate; head not very broad, depressed, the lower jaw projecting; skin naked, with several series of mucous pores; mouth wide, with conical teeth in the jaws, and a canine tooth on each side of the vomer; opercle with a single spine; first dorsal with 2 very small, stout spines; pectoral broad, without foramen in the axil; branchiostegals 6; air-bladder divided into two lateral parts; vertebræ 11 + 31. (πορος, pore; ἰχθὺς, fish; in allusion to the extraordinary development of the mucous system.)

1150. P. porosissimus (Cuv. & Val.) Günther.—*Midshipman.*

Olive brown above, with coppery reflections, the belly brassy-yellow; sides with irregular broad vertical cross-blotches, most distinct in the young; dorsal grayish, with oblique dark bars; vertical fins sometimes margined with black; pores of lateral lines bead-like, shining silvery; a white space below eye, with a black crescent below it. Head narrowed forwards; opercle developed as a strong spine; maxillary reaching beyond orbit; lower jaw with a single row of about 10 large, recurved teeth, behind which is a patch of small teeth; sides of jaw with a single series of canines similar to those in front, but larger; upper jaw with an irregular series of small teeth; palatines with a single

series of conical teeth; 2 large curved canines on vomer; head with several rows of fringed pores: one row along lower line of opercle and subopercle; another along upper edge of cheeks, this branching behind and below the orbit, one branch running forwards below the orbit and around the snout, the other vertically downwards behind the maxillary; a series of fringes behind the lower lip; behind this a series of pores without fringes; a short straight series of pores on each side of vertex; a row of pores along the base of the dorsal fin, curving at front of dorsal, and terminating at upper angle of opercle; a row below this, not reaching base of pectoral; a third row does not reach the base of caudal, and is anteriorly strongly curved upwards to base of pectoral; 2 concentric series on the abdomen, the outer extending forwards between bases of ventrals. The so-called "shining pores" on the sides are not pores, but bright round pieces of shiny membrane, showing through a translucent skin; each of the spots has above it a pair of fringed flaps with a small pore between them; the rows of flaps along bases of dorsal and anal fins are without shining spots. Ventrals reaching bases of pectorals, which reach to opposite the sixth anal ray; caudal not half length of head; peritoneum black. Head $3\frac{2}{3}$; depth 6. D. II–37; A. 33; V. I, 2; P. 18. L. 15 inches. Pacific coast; very abundant from Lower California to Puget Sound; occasionally southward to Panama; also in the West Indies and on the coast of Brazil.

(*Batrachus porosissimus* C. & V. xii, 501: *Porichthys notatus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 141, and in U. S. Pac. R. R. Surv. Fish. 134; Gunther, iii, 176.)

Family CXIII.—LEPTOSCOPIDÆ.

Body oblong, low, compressed posteriorly, covered with moderate cycloid, imbricated scales; lateral line complete, anteriorly running along side of back, posteriorly median; head oblong, nearly plane above; eyes small, superior, well forward; suborbital bones enlarged, but without "stay"; nostrils double; opercle fringed; mouth nearly vertical; premaxillaries protractile, not forming the entire edge of the upper jaw; lips fringed; gill-openings very broad, the membranes separate and free from the isthmus; pseudobranchiæ present or absent. Dorsal fin very long, undivided, several of the anterior rays spinous; anal very long, commencing close behind the vent, which is near the breast; caudal diphycercal, free from dorsal and anal; pectorals variable, the base procurrent; ventrals jugular, I, 3 or I, 5; vertebræ more than 10 + 14; pyloric cœca none. Genera about 5; species about 10;

inhabiting the tropical seas. This group or family is most nearly related to the *Uranoscopidæ*, but some of the species show *Blennioid* traits.

(*Leptoscopoidæ* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 503–506.)

a. Ventral rays I, 3; pectoral rays simple. (*Dactyloscopinæ*.)
b. Pseudobranchiæ none; head cuboid; dorsal commencing at the nape.
DACTYLOSCOPUS, 400.

400.—DACTYLOSCOPUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1859, 132: type *Dactyloscopus tridigitatus* Gill.)

Body moderately elongate, covered with rather large, cycloid scales; head cuboid, oblong and nearly flat above; eyes small; interorbital space broad; mouth nearly vertical; lower jaw not dilated beneath nor emarginate in front, without barbels; no intralabial filament; teeth villiform, on jaws only; pseudobranchiæ obsolete. Dorsal commencing at the nape, with 10–12 spines; ventral rays I, 3. (δακτυλος, finger; σκοπος, short for *Uranoscopus*.)

1151. D. tridigitatus Gill.

Whitish; head with coarse wavy darker lines; fins immaculate. Body slender, much compressed posteriorly; opercular fringe of 15 separate filaments. Distance from snout to dorsal 5 in total length of body. Head 5 (in total); depth 7. D. XII, 28; A. II, 32; P. 13; V. I, 3; scales 11 + 4 + 30 = 45. West Indies, north to Key West. (*Gill.*)

(Gill, Proc. Acad. Nat. Sci. Phila. 1859, 132, 1861, 264, and 1862, 505; Günther, iii, 279.)

FAMILY CXIV.—BLENNIIDÆ.*

(*The Blennies.*)

Body oblong or variously elongate, usually compressed; naked, or covered with usually cycloid scales; teeth usually well developed; suborbital ring not articulated with the preopercle; dorsal fin long, continuous, or divided into two or three fins, the anterior portion and sometimes the whole fin composed of spines, which are stiff or flexible; anal fin long, usually with one or two small spines; ventrals jugular, few-rayed, or wanting; caudal fin present, rounded; tail diphycercal; air-bladder usually wanting; pseudobranchiæ present; gills 4, a slit behind the fourth; vertebræ numerous. Genera about 50; species nearly 300. As here understood, a large and varied family, chiefly of small carnivorous fishes, inhabiting rock-pools and sea bottoms near the shore. Some of them are found in the fresh-water lakes of Italy. Many of

*Including families 112 *Blennidæ* and 113 *Anarrhichadidæ* of the key on pages 80 and 81.

them (*Clininæ*) are ovoviviparous. Professor Gill divides this group into several families (*Anarrhichadidæ*, *Blenniidæ*, *Cebedichthyidæ*, *Xiphidiontidæ*, *Stichæidæ*, and *Cryptacanthidæ*, but the second, third, fourth, and fifth of these groups at least are very closely allied. Genera about 40; species about 250.

(*Blenniidæ* pt. Günther, iii, 206–294.)

* Molar teeth none.

a. Teeth long and slender, curved, hook-like or comb-like; in front of jaws only; body naked; dorsal with many soft rays; ventral fins well developed. Species carnivorous, oviparous, chiefly tropical. (*Blenniinæ*.)

b. Anterior teeth canine-like, unequal; some of the teeth movable; others angularly bent; gill-membranes free from isthmus ..... OPHIOBLENNIUS, 401.

bb. Anterior teeth comb-like, equal; teeth all fixed.

c. Gill-membranes broadly united to the isthmus, the gill-openings restricted to the sides.

d. Mouth large, the head rather pointed; no canines ..... CHASMODES, 402.

dd. Mouth small; the head decurved in profile.

e. Canine teeth none ..... ISESTHES, 403.

ee. Canine teeth present in one or both jaws posteriorly. HYPLEUROCHILUS, 404.

cc. Gill-membranes free from the isthmus, or at least forming a fold across it; posterior canines present .. BLENNIUS, 405.

aa. Teeth conic, not comb-like.

f. Body scaly.

g. Lateral line present (or more or less obsolete), single, high in front, abruptly curved above pectorals, becoming median posteriorly; dorsal fin with one or more soft rays; gill-membranes free from isthmus; ventrals well developed. Species carnivorous, ovoviviparous, chiefly tropical. (*Clininæ*.)

h. Soft dorsal of numerous rays; scales small.

i. Maxillary greatly developed, reaching far beyond eye; teeth on vomer and palatines ..... NEOCLINUS, 406.

ii. Maxillary moderate.

j. Air-bladder obsolete; caudal fin rounded ..... CLINUS, 407.

jj. Air-bladder large; caudal forked; teeth on palatines. HETEROSTICHUS, 408.

hh. Soft dorsal of a single ray; scales rather large; a notch behind third spine of dorsal. CREMNOBATES, 409.

gg. Lateral line, if present, straight, concurrent with the back; sometimes branched or duplicated.

k. Mouth horizontal or nearly so.

l. Gill-openings not continued forward below, the membranes broadly united, free from isthmus or not; ventral fins very small or wanting. Species carnivorous or herbivorous; oviparous (?) Arctic or subarctic. (*Xiphisterinæ*.)

m. Dorsal fin of spines only.
n. Lateral line none.
o. Gill-membranes free from the isthmus; no pyloric cœca.
p. Anal spine none; ventrals I, 3; top of head with tentacles ..... CHIROLOPHUS, 410.
pp. Anal fin with 2 small spines; ventral fins rudimentary ..... MURÆNOIDES, 411.
ppp. Anal fin with a large spine in a sheath; ventrals wanting ..... APODICHTHYS, 412.
oo. Gill-membranes joined to the isthmus; no ventral fins; no anal spines; pyloric cœca.
ANOPLARCHUS, 413.
nn. Lateral lines several; pyloric cœca present; gill-membranes free from isthmus; ventrals none; anal spines small.
XIPHISTER, 414.
mm. Dorsal fin with its posterior half composed of soft rays; gill-membranes broadly united, free from isthmus; ventrals wanting; lateral line single, high; pyloric cœca present
CEBEDICHTHYS, 415.
ll. Gill-openings prolonged forward below, separated by a narrow isthmus; pectorals nearly as long as head; ventrals well developed. Oviparous, herbivorous. Arctic. (*Stichæinæ.*)
q. Lateral line present.
r. Lateral line forked or duplicated.
EUMESOGRAMMUS, 416.
rr. Lateral line simple, median ... STICHÆUS, 417.
rrr. Lateral line simple, dorsal.
NOTOGRAMMUS, 418.
qq. Lateral line obsolete.
s. Teeth on vomer or palatines. LUMPENUS, 419.
ss. Teeth on jaws only .... LEPTOBLENNIUS, 420.
kk. Mouth nearly vertical; gill-membranes attached to the isthmus; scales small; lateral line obsolete; no ventrals; dorsal of spines only. (*Cryptacanthodinæ*) ..... DELOLEPIS, 421.
ff. Body naked; dorsal fins of spines only; ventrals obsolete.
t. Gill-membranes joined to the isthmus; lateral line obsolete; pyloric cœca present; mouth nearly vertical; teeth strong, on jaws, vomer, and palatines.
CRYPTACANTHODES, 422.
aa. Molar teeth strong, on vomer, palatines, and sides of lower jaw; dorsal of flexible spines only; scales minute; gill-membranes joined to the isthmus; no ventral fins; air-bladder present; no lateral line. (*Anarrhichadinæ.*)
u. Caudal fin distinct; body moderately elongate ..... ANARRHICHAS, 423.
uu. Caudal fin confluent with dorsal and anal; body eel-shaped.
ANARRHICHTHYS, 424.

401.—OPHIOBLENNIUS Gill.

(*Blennophis* Valenciennes; preoccupied.)

(Gill, Proc. Acad. Nat. Sci. Phila. 1860, 103: type *Blennophis webbii* Val.)

Body moderately elongate, strongly compressed, scaleless; snout short, high, abruptly decurved anteriorly; symphysis of lower jaw with 4 hooked canines, the outer strongest and bent backward, almost forming a right angle; sides of lower jaw with 2 or 3 still larger canines, the hindmost very large and bent backward; upper jaw with 4 slender canines in front, followed by a long row of shorter, slender, movable teeth, which are set close together; nasal tentacle digitate; a low simple tentacle above eye; gill-openings wide. Dorsal fin long, the spines slender, separated by a slight notch from the soft rays; caudal lunate, free from dorsal and anal; ventrals moderate, I, 2; pectorals large. (ὄφις, snake; Blennius.)

1152. O. webbi (Val.) J. & G.

Dark golden-brown, sometimes with a broad cross-band of dusky violet on back and dorsal fin; caudal with 2 dark longitudinal stripes; dorsal and anal purplish or orange; an intense, round, dark, ocellated spot behind eye. Head much compressed; eye $3\frac{1}{4}$ in head; snout $4\frac{1}{2}$. Dorsal beginning above gill-opening, ending just before caudal; its soft rays somewhat higher than the spines, the highest spine $1\frac{3}{5}$ in head; caudal and pectorals each about as long as head; ventrals $1\frac{1}{2}$ in head. Head 4; depth $4\frac{1}{4}$. D. XI–22; A. II, 23; V. I, 2; P. 15. "Western coast of Southern California" to Mazatlan, Barbadoes, and Canary Islands. (*Steindachner.*)

(*Blennophis webbii* Valenciennes; Webb & Berthelot, Iles Canar. Poiss. 60: *Blennophis webbi* Günther, iii, 259; Steindachner, Ichth. Beiträge, viii, 41, 1879.)

402.—CHASMODES Cuvier & Valenciennes.

(Cuv. & Val. Hist. Nat. Poiss. xi, 295, 1836: type *Blennius bosquianus* Lac.)

Body oblong, compressed, naked; head triangular in profile, the snout somewhat pointed; mouth large, with lateral cleft, the maxillary usually extending to beyond eye; premaxillaries not protractile; teeth in a single series, long and slender, comb-like, confined to the front of each jaw; no canines; cirri very small or wanting; gill-openings very small, their lower edge above the middle of the base of the pectorals; lateral line incomplete. Fins as in *Blennius*. American. (χασμώδες, yawning.) (See Addenda.)

1153. C. bosquianus (Lac.) Cuv. & Val.

Color (in ♂) olive green, with about nine horizontal narrow blue lines,

these somewhat irregular and interrupted, converging backwards; opercular membrane and a broad stripe through middle of spinous dorsal deep orange-yellow; anal fin dark, the rays with white membranaceous tips; ♀ dark olive green, reticulated with narrow pale green lines, and with several broad dark bars, which are more distinct posteriorly; vertical fins similarly marked; head finely dotted with black; a dusky spot at base of caudal in both sexes. Orbital tentacle very minute or wanting; maxillary extending to rather beyond eye; interocular space very narrow, not concave. Dorsal fin not emarginate, the spines slender. Dorsal joined to base of caudal; anal free. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. XI, 19; A. 20. New York to Florida; chiefly southward.

(*Blennius bosquianus* Lac. Hist. Nat. Poiss. ii, 493, 1800 (♀); Günther, iii, 229: *Pholis novemlineatus* Wood, Journ. Acad. Nat. Sci. Phila. iv, 280, 1824 (♂): *Chasmodes novemlineatus* Günther, iii, 229.)

1154. C. quadrifasciatus (Wood) C. & V.

Body with 4 distinct brownish bands, a fifth broader and less marked on the neck; four round yellowish spots along base of anal; head spotted with blackish. Lower jaw slightly longer than the upper. Dorsal fin free from the caudal; anal fin highest anteriorly. D. 27; A. 15. (*Wood.*) Habitat uncertain, probably South Atlantic coast of the United States.

(*Pholis quadrifasciatus* Wood, Journ. Acad. Nat. Sci. Phila. iv, 282, 1824; Günther, iii, 229.)

403.—ISESTHES Jordan & Gilbert.

(Gen. nov.: type *Blennius gentilis* Girard.)

This genus differs from *Blennius* in the absence of canine teeth and in the restriction of the gill-openings to the sides, the gill-membranes being fully united to the isthmus as far as the base of the pectorals. The known species are American. (ἴσος, equal; ἐσθίω, to eat; in allusion to the uniformity of the teeth.) (See Addenda.)

1155. I. gentilis (Grd.) J. & G.

Olivaceous, body and fins marbled and spotted with darker; anal pale-edged; a blue spot on the dorsal in front; males with golden stripes on lower parts of head. Gill-openings extending downward to lower edge of pectorals. Head large, short and blunt, the profile of snout steep; supraorbital cirrus large, multifid, as high as eye; interorbital space convex, less than half width of orbit; no canines. Dorsal fin not emarginate, free from caudal, its spines stiff, lower than soft rays, $2\frac{1}{2}$ in head; pectorals reaching anal; ventrals half way to vent;

lateral line present anteriorly, ending above anal. Head $3\frac{1}{2}$; depth 4. D. XII, 19; A. 21; P. 14. L. 5 inches. Coast of California, from Point Concepcion southward.

(*Blennius gentilis* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 149: *Blennius gentilis* Günther, iii, 217: *Blennius gentilis* Steindachner, Ichth. Beiträge, v, 150, 1876.)

1156. I. punctatus (Wood) J. & G.

Light olivaceous, with darker reticulations, forming ill-defined vertical bars; head with very distinct black dots; a series of black dots on each side of lateral line; dorsal with a black blotch in front and with the lateral bars extending on it; anal fin blackish, the rays tipped with white; caudal barred. Body rather deep; head large, obtuse; interorbital space concave, half the diameter of orbit; orbital cirrus as long as dorsal spines, bifid at tip, branched below; a minute nasal cirrus; no canines; gill-openings extending to about lower fourth of base of pectoral, thus narrower than in *I. gentilis*. Dorsal fin high, little notched, the soft part highest, the spines stiff, $2\frac{2}{3}$ in head. Head $3\frac{2}{5}$; depth $3\frac{1}{2}$. D. XII, 15; A. 19. Coast of North and South Carolina.

(*Blennius punctatus* Wood, Journ. Acad. Nat. Sci. Phila. iv, 278, 1825: *Blennius punctatus* Günther, iii, 228: ? *Blennius hentz* Le Sueur, Journ. Acad. Nat. Sci. Phila. iv, 363, 1825: ? *Hypsoblennius hentzi* Gill, Cat. Fish. East Coast N. Amer. 1861, *nomen nudum*.)

404.—HYPLEUROCHILUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 168: type *Blennius multifilis* Grd.)

This genus differs from *Blennius* in the restriction of the gill-openings to the sides, the gill-membranes being broadly and fully joined to the isthmus. (ὑ, upsilon; πλεῦρον, side; χεῖλος, lip; the allusion not evident.)

1157. H. multifilis (Grd.) Gill.

Dusky brown, back and vertical fins with roundish spots, most conspicuous in the young. Head short, the profile bluntly decurved; maxillary reaching to below middle of eye; four canine teeth, those in the lower jaw larger than those in upper; supraocular cirri very high, each with four smaller ones at base. Dorsal fin not emarginate, the soft rays rather higher than the slender flexible spines; membrane of last ray almost reaching base of caudal; origin of anal in advance of that of soft dorsal; pectorals broad, reaching beyond front of anal; ventrals long, nearly reaching vent. Head $3\frac{3}{4}$; depth about same. D. XIII, 14; A. II, 18; V. I, 3. Coast of Texas. (*Grd.*)

(*Blennius multifilis* Girard, U. S. Mex. Bound. Surv. 1859, 27, pl. xii, f. 6: *Blennius multifilis* Günther, iii, 562; Gill, Proc. Acad. Nat. Sci. Phila. 1861, 168.)

1158. H. geminatus (Wood) J. & G.

Olive brown, faintly barred with darker; sides plain (in our specimens), or with "several pairs of spots of a reddish-brown color, arranged pretty regularly in a double row" (*Wood*); vertical fins edged with darker, especially the anal; dorsal black in front. Head not very blunt, the anterior profile straight, oblique; orbital cirrus not large, shorter than eye, branched at tip; interorbital space concave, not half diameter of eye; a slight transverse groove behind eye; canines in both jaws very strong, hooked backwards, the lower considerably stronger than upper; gill-openings extending downward to opposite or slightly below lower edge of pectoral. Dorsal fin not emarginate, the spines slender, but rather stiff, lower than the soft rays; pectorals shortish, ventrals rather long. Head $3\frac{1}{3}$; depth 4. D. XI, 15; A. 18. L. $2\frac{1}{2}$ inches. South Atlantic coast of the United States; abundant in empty shells and clusters of tunicates.

(*Blennius geminatus* Wood, Journ. Acad. Nat. Sci. Phila. iv, 278, 1824: ?*Blennius geminatus* Günther, iii, 228.)

405.—BLENNIUS Linnæus.

Blennies.

(Artedi; Linnæus, Syst. Nat.: type *Blennius ocellaris* L.)

Body oblong, compressed, naked; head short, the profile usually bluntly rounded; mouth small, horizontal, with a single series of long, slender, curved, close-set teeth in each jaw, besides which, in the lower jaw at least, is a fang-like canine tooth on each side; premaxillaries not protractile; gill-openings wide, extending forward below, the membranes free from the isthmus, or at least forming a fold across it. Dorsal fin entire, or more or less emarginate, usually free from caudal, the spines slender; pectorals moderate; ventrals well developed, I, 3; no pyloric cœca; lateral line developed anteriorly. Species very numerous, lurking under rocks and algæ in all warm seas; some species in the lakes of Northern Italy. (*Blennius*, the ancient name, from βλεννα, slime.)

a. Orbital cirri present. (*Blennius.*)

b. Both jaws with canine teeth.

c. Dorsal little emarginate.

1159. B. fucorum Cuv. & Val.

Olive green, becoming darker above, with numerous brown spots on the cheeks and sides of the body; below faintly reddish. Orbital

cirri nearly as long as head, bifid above, and with fringes at the base. Dorsal fin slightly emarginate, free from the caudal, the spines rather stiff. Head very short and deep, its profile nearly vertical; both jaws with very strong canines. Gill-membranes free from isthmus posteriorly. Head 5 in total length. D. XI, 17; A. 18. Open ocean, from near the Azores; said to have been once taken off the coast of New York.

(Cuvier & Valenciennes, xi, 263; Günther, iii, 217; Dekay, New York Fauna, Fish. 149, pl. 22, fig. 66.)

aa. Orbital cirri none. (*Pholis** Fleming.)

1160. B. carolinus (C. & V.) J. & G.

Greenish, with 4 or 5 irregular dark spots or shades along the back; dorsal with a large black spot in front; anal brown-edged. Body rather long and slender, more elongate than in *Blennius pholis*, more compressed, the head longer; maxillary extending to opposite middle of eye; teeth $\frac{16}{14}$, with strong canines in both jaws. Gill-membranes free from isthmus; no trace of tentacles above eye. Dorsal spines slender, a little lower than the soft rays, the fin little emarginate; dorsal and anal not joined to the caudal. D. XII, 18; A. 17. South Carolina. Only the original type in the museum at Paris known; from this the present description was taken.

(*Pholis carolinus* Cuv. & Val. xi, 276.)

406.—NEOCLINUS Girard.

(Girard, U. S. Pac. R. R. Surv. Fish. x, 114, 1858: type *Neoclinus blanchardi* Girard.)

Body compressed, rather elongate, covered with minute cycloid scales; lateral line present, incomplete, high anteriorly; head naked, the cheeks tumid; upper jaw protractile; maxillary greatly produced backward, more than two-thirds length of head, reaching far beyond the eye; both jaws, vomer, and palatines with stout, unequal, conical teeth in a single series, besides which, in the front of the jaws, are smaller teeth; nasal and supraocular region with fringed tentacles; gill-membranes broadly united, free from the isthmus; gill-rakers weak. Dorsal fin long, scarcely emarginate, its anterior two-thirds composed of slender, flexible spines, which are similar to the soft rays, all of which are simple; anal long, its rays all simple; ventrals moderate, I, 3; caudal fin distinct; pectorals rather broad, rounded; no air-bladder; no pyloric cœca. Pacific Ocean. (νέος, new; κλίνος, Clinus.)

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* Fleming, Brit. Anim. 207: type *Blennius pholis* L. (θολίς, ancient name of some fish which was believed to shelter itself in a cloud of mucous which it produced.)

1161. N. satiricus Girard.

Dark brown, nearly uniform; maxillary flap broadly edged with bright yellow. Head bluntish, convex in profile; eyes large, high up, well forward, separated by a rather narrow flattish interorbital space; top of head convex; cheeks long; opercles short. Head larger, and teeth rather stronger than in *N. blanchardi;* maxillary enormously developed, reaching about to gill-opening, its length varying with age; provided at tip and inner margin with a very broad wing-like flap, which is joined to the lower part of the cheek; this membrane is more than twice the diameter of the eye; below it is another membrane connecting this with the lower jaw; supraorbital cirrus quite small, but present. Head $3\frac{1}{2}$; depth 6; maxillary with flap, $3\frac{1}{3}$. D. 43; A. 29. L. 12 inches. Monterey, Cal.; a rare and most interesting species.

(*Neoclinus satiricus* Girard, Proc. Acad. Nat. Sci. 1859, 57; Günther, ii, 260.)

1162. N. blanchardi Girard.

Dark red or plum color, with olive-green blotches on the side; belly olive, speckled with lighter; front of mouth red; fins colored like the body; a black spot ocellated with yellow between the first and second dorsal spines; 2 light-yellow spots at base of caudal; dorsal and caudal tinged behind with yellow; anal and pectorals chiefly vermilion; color quite variable, some specimens duller or barred. A long cirrus, much longer than eye, above the front of the eye; reddish at base, its fringed tips bright yellow; a short, multifid, nasal barbel, and a cluster of 3 or 4 fringed barbels behind supraocular cirrus. Maxillary two-thirds length of head, 6 in body, large, reaching nearly to opposite front of dorsal; lateral line ending opposite the vent, only its straight anterior portion being developed. Dorsal spines one-third length of head. Head 4; depth 5. D. XXVI, 17; A. 30. Coast of California, north to Monterey.

(Girard, U. S. Pac. R. R. Surv. Fish. 1858, 114; Günther, ii, 259.)

407.—CLINUS Cuvier.

(Cuvier, Règne Anim. ii, 1817: type *Clinus acuminatus* C. & V.)

Body more or less elongate and compressed, covered with small or minute scales, which are usually cycloid; lateral line complete, abruptly decurved behind the pectoral; head obtuse or somewhat pointed; stout, unequal, conical teeth on jaws and vomer, and sometimes on palatines; the teeth mostly in single series, except in front;

no conspicuous posterior canines; maxillary not produced backward from angle of mouth; gill-membranes united, free from the isthmus. Dorsal fin long and low, chiefly composed of spines; some of the anterior spines often different from the others, longer or shorter, and set farther apart; anal fin low, with 2 spines; ventral fins jugular, of 1 spine and 2 or 3 rays; caudal fin truncate; branchiostegals 6; air-bladder and pyloric cœca absent; viviparous. Inhabiting rock-pools among algæ, in warm seas. Our two species are very different, and represent opposite extremes in this large and varied genus. (*κλίνος*, a name of some sleepy fish; from *κλίνη*, a bed.)

a. Nape with a fringe of filaments; teeth on vomer and palatines; scales moderate. (*Labrosomus** Swainson.)

1163. C. nuchipinnis Quoy & Gaimard.

Reddish brown, sometimes with vertical bands; a black spot on opercle, which is often edged with white; cheeks and fins reticulate or dotted. Body oblong, rather robust; head naked, thick, short, not very obtuse anteriorly, compressed above; mouth rather large, the maxillaries not prolonged backward, extending to opposite the posterior part of eye, $2\frac{1}{2}$ in head; teeth on jaws, vomer, and palatines; front teeth of jaws conic, strong; eyes large; interorbital space very narrow; each side of neck with a long series of hair-like filaments, nearly as long as eye; orbital tentacle short and broad, multifid; nostrils with a tufted barbel; lower jaw slightly projecting, its posterior teeth sometimes recurved; pectorals a little shorter than head, reaching vent. Dorsal spines rather slender, the three anterior spines scarcely shorter than the others; all the spines lower than the soft rays; dorsal fin commencing near the nape, the spinous portion long; soft rays higher than the spines; caudal small; pectorals rather large; ventrals moderate; gill-membranes broadly united, free from the isthmus; lateral line complete, high anteriorly, then abruptly decurved; membranes of vertical fins scaly; scales not very small, cycloid. Head $3\frac{1}{2}$; depth $3\frac{1}{2}$. D. XVIII, 12; A. II, 17; Lat. l. 70. L. 8 inches. West Indies; occasional on our South Atlantic coast.

(*Clinus nuchipinnis* Quoy & Gaimard, Voy. Urania Zoöl. 255: *Clinus pectinifer* Cuv. & Val. xi, 374: *Lepisoma cirrhosum* Dekay, N. Y. Fauna, Fish. 1842, 41: *Clinus nuchipinnis* Günther, iii, 262: *Labrosomus pectinifer* Gill, Proc. Acad. Nat. Sci. Phila. 1860, 105.)

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* Swainson, Class. Fish. ii, 75, 1839: type *Clinus pectinifer* Cuv. & Val. = *Clinus nuchipinnis* J. & G. (*Labrus; σῶμα*, body.)

aa. Nape without fringe of filaments.

b. Head pointed; no palatine teeth; spinous dorsal notched behind fifth spine; scales minute. (*Gibbonsia** Cooper.)

1164. C. evides J. & G. nom. sp. nov.

Usual color of adult translucent, reddish or orange, nearly plain; a large pellucid spot on the membrane behind third dorsal spine, and some small ones behind it; pectorals barred; young specimens variously variegated, with light and dark shades of red, brown, and white, the hue varying exceedingly and dependent on the surroundings; a dark spot usually present behind gill-opening. Body elongate, compressed; head small, rather pointed; mouth quite small, terminal, the maxillary about reaching pupil, $3\frac{1}{4}$ in head; lower jaw projecting; no teeth on palatines; posterior teeth not recurved; eye moderate, shorter than snout, nearly 6 in head; a small supraocular flap, not higher than pupil. First spine of dorsal inserted over preopercle, its length more than one-third that of head; the second nearly equal; the third, fourth, and fifth progressively shorter; the sixth about as long as fourth; the seventh longer; the rest nearly equal to the last, which is lower than the soft rays; pectorals short, not reaching vent; ventrals short; scales very small, smooth; head naked; no air-bladder. Head $4\frac{2}{3}$; depth $4\frac{2}{3}$. D. V, XXXI, 10; A. II, 26. L. 9 inches. Coast of California, from Monterey southward; in rock-pools; very abundant.

(*Myxodes* (*Gibbonsia*) *elegans* Cooper, Proc. Cal. Acad. Nat. Sci. iii, 109, 1864: *Blakea elegans* Steindachner, Ichth. Beiträge, v, 148, 1876; not *Clinus elegans* C. & V.)

408.—HETEROSTICHUS Girard.

Kelp-fishes.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 143: type *Heterostichus rostratus* Grd.)

Body rather elongate, compressed, covered with very small, smooth scales; head long and low, the snout conic, produced, very acute; premaxillaries protractile; mouth moderate, terminal; each jaw with a row of conical teeth, behind which anteriorly is a broad patch of villiform teeth; vomer and palatines with villiform teeth; gill-rakers feeble; gill-membranes broadly united, free from the isthmus; orbital cirri minute or wanting; cheeks scaly. Dorsal fin very long, the posterior rays soft, the five anterior spines wider apart than the rest and separated from them by a notch, the first and second spines longest, rather flexible, the other spines stiff; caudal fin forked; ventrals I, 3; pec-

*Cooper, Proc. Cal. Acad. Nat. Sci. iii, 109: type *Myxodes elegans* Cooper. (Dedicated to Dr. J. P. Gibbons.)

torals moderate; lateral line simple, complete, abruptly curved behind pectorals; air-bladder present, large. Size large. (ἕτερος, different; στίχος, rank; in allusion to the anterior dorsal spines.)

1165. H. rostratus Grd.—*Kelp-fish.*

Translucent reddish brown, varying to blackish or olive, with traces of shining pale bands on the sides, and dark vertical bars, the hue and pattern of color varying greatly; young specimens most variegated; a translucent spot behind third dorsal spine. Body much compressed, deepest anteriorly; head slender, compressed and pointed; lower jaw projecting, with thick lip; maxillary reaching pupil, $2\frac{2}{3}$ in head; eye large, 7 in head; orbital cirrus minute, usually entirely wanting; cheeks and upper edge of opercle with small scales, rest of head naked; middle rays of caudal about two-thirds length of outer. Head $3\frac{3}{4}$; depth $3\frac{3}{4}$; B. 6. D. V, XXXII, 13; A. II, 34. L. 15 inches. San Francisco to San Diego. The largest of the *Blennies* which are allied to *Clinus*.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 143; Girard, U. S. Pac. R. R. Surv. Fish. 36; Günther, ii, 264, and iii, 261.)

409.—CREMNOBATES Günther.

Auchenopterus Günther, preoccupied.)

(Günther, Proc. Zoöl Soc. Lond. 1861, 374: type *Auchenopterus monophthalmus* Gthr.)

Body moderately elongate, compressed, covered with rather large cycloid scales; head shortish, naked; cheeks full; mouth moderate, with a band of conical teeth in the jaws and about one series on the vomer; none on the palatines; gill-membranes united, free from the isthmus; upper surface of head with tentacles. Dorsal fin low, composed of stiff spines, with but a single soft ray, which is lower than the spines; first three spines more or less separated from the others; anal fin low, with two spines; ventrals jugular, well developed; pectorals broad; lateral line complete, strongly curved anteriorly. Warm seas. This genus differs from *Cristiceps* in having but one soft ray in the dorsal fin, and in the well-developed scales. (κρημνοβάτης, one who haunts rocks.)

a. Three anterior spines connected to the others by membrane.

1166. C. integripinnis Rosa Smith.

Color dark brown, variegated with different shades of brown and

reddish; about 5 indistinct dark cross-bars; a distinct ocellated black spot on posterior part of dorsal fin; caudal fin translucent, speckled; a black bar at its base; base of pectorals violet, bordered with black, the rest of the fin checkered; ventrals barred. Head stout, broad, conical; mouth little oblique; eyes large; nasal, supraocular and nuchal regions with fringed cirri, those at the nape flap-like. First and second dorsal spines low, a little higher than the third, which, in turn, is higher than the fourth, and separated from it by an interspace; the membrane between the third and fourth spines deeply emarginate; anterior spines not forming a separate fin; highest anterior spine not higher than the highest of the posterior part of fin. Head 4; depth $4\frac{1}{3}$. D. III, XXVIII, 1; A. II, 20; V. I, 3; Lat. l. 38. L. $2\frac{1}{2}$ inches. San Diego, California, southward to Mazatlan; abundant in rock-pools.

(*Cremnobates integripinnis* Rosa Smith, Proc. U. S. Nat. Mus. 1880, 147.)

410.—CHIROLOPHUS Swainson.

(*Blenniops* Nilsson: *Carelophus* Kröyer.)

(*Chirolophis* Swainson, Class. Fish. ii, 275, 1839: type *Blennius yarrelli* C. & V. = *Blennius ascanii* Walb.)

Body moderately elongate, covered with small scales; no lateral line; snout short; no teeth on vomer or palatines; teeth in jaws small; gill-membranes united, free from the isthmus; nostrils, orbital region, and neck with dermal flaps, the supraorbital flaps high. Dorsal fin long, of spines only; ventrals well-developed, jugular; caudal fin distinct. No air-bladder or pyloric cœca. Northern seas; one species known from Europe; a second species, imperfectly described by Pallas, may be provisionally placed with it. (χεῖρ, hand; λοφος, crest; apparently καρα, head, was intended, which would make "*Carelophus*.")

1167. C. (?) **polyactocephalus** (Pallas) J. & G.

Form of *Zoarces*. Body compressed, covered with soft imbedded scales; head very short, retuse; lower jaw longer; "both jaws without teeth"; (?) eyes approximate; interorbital space with 2 minute cartilaginous spinules; 2 large superciliary cirri; vertex behind orbits subexcavated, with 2 series of erect cirri. Dorsal fin beginning at the neck, extending to the caudal; ventrals undescribed. D. LXX. Kamtschatka (*Pallas*) and Alaska.

(*Blennius polyactocephalus* Pallas, Zoöl. Ross.-Asiat. iii, 179, 1811.)

411.—MURÆNOIDES* Lacépède.

Butter-fishes.

(*Centronotus* Bloch: *Gunnellus* Cuvier.)

(Lacépède, Hist. Nat. Poiss. ii, 324, 1800: type *Murænoides sujef* Lacép. = *Blennius gunnellus* L.)

Body long and low, considerably compressed, somewhat band-shaped, the tail slowly tapering; head small, compressed, naked or scaly; mouth rather small, oblique; jaws with rather small teeth in narrow bands or single series; vomer and palatines usually toothless; gill-membranes broadly united, free from the isthmus; scales very small,

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* Little known species related to *Murænoides*, recorded from Kamtschatka, and doubtless occurring also in Alaska, are the following:

M. tænia (Pallas).

Body banded; teeth obtuse, subdistinct; head subtriangular, compressed; body ensiform, covered with minute imbedded scales; vent median. Dorsal fin extending from near the head to the tail, the spines subequal; caudal subdistinct; pectorals small; ventrals represented by 2 recurved spines. D. LXXXVII; A. 47. Kurile Islands. (*Pallas.*)

(*Blennius tænia* Pallas, Zoogr. Ross.-Asiat. iii, 178.)

M. ruberrimus (Cuv. & Val.)

Bright red. Form of preceding; scales inconspicuous; ventrals each a single scarcely projecting spine; caudal broad, rounded, distinct. D. CXV. Kurile Islands. (*Pallas.*)

(*Gunnellus ruberrimus* Cuv. & Val. xiv, 440, after Pallas, l. c. 178.)

M.? ocellatus (Tilesius.)

Brownish, marked with yellow and purple; six black ocellated spots along the dorsal fin. Caudal distinct; ventrals none. D. LXXX; A. 50. Otherwise essentially as in *M. gunnellus*. Kamtschatka. (*Cuv. & Val.*)

(*Ophidium ocellatum* Tiles. Mém. Acad. St. Petersb. ii, 237, 1811: *Gunnellus apos* Cuv. & Val. xiv, 426: *Centronotus apus* Gthr. iii, 288.)

GUNNELLOPS Bleeker.

(Bleeker: type *Blennius roseus* Pallas.)

Apparently distinguished from *Murænoides* by the tapering tail, around which the vertical fins are confluent; palatine teeth present.

(*Gunnellus*, Gunnel, an old name of *Murænoides gunnellus*; ὤψ, eye.)

G. roscus (Pallas) Bleeker.

Intensely red. Head obtuse, the lower jaw projecting; eyes large; body very long, compressed, tapering into a slender tail; pectorals small, ovate, hyaline; 2 spines in place of ventrals; dorsal extending from the nape to the end of the tail; anal joined to caudal. D. ca. 100; A. ca. 90; P. 9; V. I. Kurile Islands.

(*Blennius roseus* Pallas, l. c. 177: *Centronotus roseus* Gunther, iii, 290.)

smooth; no lateral line. Dorsal fin long and low, beginning near the head, composed entirely of stiff, sharp, subequal spines; anal similar in form, of two spines and many soft rays; caudal fin short and small, sometimes joined to dorsal and anal; pectorals short; ventrals very small, of one spine and a rudimentary ray (obsolete or wanting in some imperfectly-known species provisionally referred to this genus); intestinal canal short, without cœca. Shore fishes of the Northern fishes of the Northern seas. (*μυραινα*, an eel; *εἶδος*, form.)

b. Ventrals present, I, 1. (*Murænoides.*)

1168. M. gunnellus (L.) Gill.—*Butter-fish.*

Olive brown; sides with numerous obscure darker bars; base of dorsal with ocellated dark spots; a dark bar below eye. Head short and compressed, scaleless; mouth oblique; maxillary reaching front of pupil; caudal fin distinct; pectorals little more than half length of head; ventrals of a spine and a rudimentary ray. Head about 8; depth 9. D. LXXVIII; A. II, 38; V. I, 1; vert. 85. L. 12 inches. North Atlantic; abundant both in America and Europe.

(*Blennius gunnellus* L. Syst. Nat. i, 443: *Centronotus gunellus* Günther, iii, 285: *Ophidium mucronatum* Mitch. Trans. Lit. & Phil. Soc. i, 361, 1815: *Gunnellus macrocephalus* Girard, Bost. Journ. Nat. Hist. vi, 263, 1850: *Gunellus ingens* Storer, Bost. Journ. Nat. Hist. vi, 261, 1850; perhaps an abnormal specimen rather than a different genus.)

1169. M. fasciatus (Bloch & Schn.) Gill.

Grayish or brownish, marbled with darker, anteriorly with several irregular cross-bands, which reach the abdomen; back with a series of 10 or 12 subtriangular pale spots along the base of dorsal, each spot including some brown specks; a brown-edged pale vertical band behind eye; a brownish band from below the eye to the throat. Mouth very oblique, the snout short; interorbital width less than diameter of eye; pectoral scarcely half as long as head; ventrals very small; vertical fins not joined. Head $9\frac{1}{2}$; depth 9. D. LXXXVIII; A. II, 42; V. I, 1. Greenland to Alaska. (*Günther.*)

(*Centronotus fasciatus* Bloch & Schneider, 165, 1801: *Gunnellus fasciatus* and *grœnlandicus* Cuv. & Val. xi, 441, 442: *Centronotus fasciatus* Günther, iii, 287: ? *Centronotus gunelliformis* Günther, iii, 288.)

1170. M. ornatus (Grd.) Gill.

Usually greenish above, yellow or orange below, but varying to brown and cherry-red; traces of about 20 darker bars along sides; a

dark bar downward from eye; fins reddish; a V-shaped mark from eyes to occiput, grayish, bordered by jet black; the common form (*lætus* Cope) with about 14 red spots along base of dorsal, each with a curved black bar in front and behind, partly encircling it; others (*ornatus*) with about as many broad ⋀-shaped darker blotches, which extend on the fin, the first one or two blotches often shaped as in the form called *lætus*. Head naked, very narrow above; nape nearly equidistant between origin of dorsal and front of orbit; origin of anal equidistant between base of caudal and base of pectoral; pectoral 2 in head; ventrals each consisting of a spine and a ray. Head 8; depth 8. D. LXXXVIII; A. II, 37. L. 12 inches. San Francisco to Alaska; very abundant northward.

(*Gunnellus ornatus* Grd. Proc. Acad. Nat. Sci. Phila. 1854, 149: *Centronotus nebulosus* Gthr. iii, 287, part, but the Japanese *M. nebulosus* is a different species: *Centronotus lætus* Cope, Proc. Amer. Phil. Soc. Phila. 1873.)

1171. M. maxillaris Bean.

Brown; back with a series of 11 rounded or oblong pale spots, the longest half as long as the head; all of these spots include at the top a rather large brown spot, and below numerous little brown spots; between the first and second pale blotches are 2 very dark spots on the dorsal membrane, and below the dark spots a pale one of similar size; sides with about 26 pale bands, mostly well defined, especially anteriorly; interorbital space with a brown band, preceded and followed by a pale band half as wide; below eye 2 whitish bands, with a brown one between them. Head scaleless; mouth little oblique, the lower jaw on level of middle of eye; width of mouth equal to length of pectoral and nearly half head; mandible as long as pectoral. Eye equal to snout, a little more than interorbital width; ventral spine $\frac{2}{3}$ eye. Highest dorsal spines near front of fin, half length of mandible; caudal half head; vent under forty-third dorsal spine, not far behind middle of body. Head 8; depth 7. D. LXXXVIII; A. II, 43; V. I, 1. Saint Paul Island, Alaska. (*Bean.*)

aa. Ventrals reduced to a rudiment.

1172. M. dolichogaster (Pallas) J. & G.

Brownish olive, marbled with yellowish; fins yellowish; dorsal fin with distant pale vertical bands; snout very short; cleft of mouth oblique; a pair of small bony warts ("verrucæ osseæ e cute prominulæ") in place of ventrals. Caudal fin well developed, the dorsal

and anal joined to its base. Head 7; depth 10. D. LXXXIII; A. II, 50. L. 12 inches. Kamtschatka and Aleutian Islands. (*Pallas.*)

(*Blennius dolichogaster* Pallas, Zoogr. Ross.-Asiat. iii, 175, 1811: *Centronotus dolichogaster* Günther, iii, 289.)

aaa. Ventrals entirely wanting. (*Asternopteryx* Rüppell.)

1173. M. gunelliformis (Rüppell) J. & G.

Reddish brown, with 10 brown cross-bands, most distinct on base of dorsal and anal; light blotches along dorsal fin, each between two of the brown cross-bands, and each with a brown spot in the center; a light, brown-edged, vertical band below eye. Ventrals none; snout short; cleft of mouth oblique; width of interorbital space less than diameter of eye; length of pectoral 3 in head. Dorsal spines short and stiff; caudal distinct. Head 8½; depth 8. D. LXXXI; A. II, 41. (*Günther.*) Type supposed to be from Greenland.

(*Asternopteryx gunelliformis* Rüppell MSS.: *Centronotus gunelliformis* Günther, iii, 288.)

412.—APODICHTHYS Girard.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 150: type *Apodichthys flavidus* Girard.)

Body elongate, compressed, covered with very small scales; no lateral line; snout short; mouth moderate, oblique; teeth in the jaws moderate, stouter anteriorly; vomer with teeth; gill-membranes united, free from the isthmus. Dorsal fin long, low, even, of spines only; anal fin similar, preceded by a large spine in a pouch of skin; caudal fin short, connected with dorsal and anal; no ventral fins; pectoral fins small; intestinal canal short, without pyloric cœca. Small bright-colored fishes of the Pacific. (απους, without feet; ἰχθύς, fish; in allusion to the want of ventral fins.)

a. Anal spine very long, pen-shaped, excavated on anterior surface. (*Apodichthys.*)

1174. A. flavidus Girard.

Color orange, varying with the surroundings to intense grass-green, brown, and dark purple; a few light round spots along axis of body posteriorly; a narrow black bar downwards and backwards from eye; a shorter, less-distinct bar from upper margin of orbit backwards to occiput; anal fin obliquely barred with brownish. Head short; mouth very oblique; maxillary reaching pupil; upper jaw with a series of conical teeth, behind which is a patch of smaller teeth; sides of mandible with conical teeth in a single series, forming a patch in front; vomer with three conical teeth; palatines toothless; nape equidistant between

front of dorsal and pupil. Anal spine very large, two-fifths the length of head, shaped like a pen, deeply excavated on its anterior side, and very convex behind, very thin, flexible, and with sharp edges, entirely included in a pouch of skin; pectoral fins about two-fifths length of head. Head $9\frac{1}{3}$; depth $7\frac{1}{3}$. D. XCIII; A. I, 40. L. 18 inches. Point Concepcion to Vancouver Island; abundant; usually found below low tide-mark.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 150; Günther, iii, 290: *Apodichthys viresens* Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 55: *Apodichthys inornatus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 279: *Apodichthys sanguineus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 279.)

aa. Anal spine small, not pen-shaped nor excavated.

1175. A. fucorum Jor. & Gilb.

Bright olive-green or deep red, the color varying with the surroundings; a row of dark spots along axis of body, these sometimes with light-bluish center, and connected by a very narrow dark streak; generally a dark streak downward from eye, but no other markings about head. Form and dentition as in *A. flavidus*. Mouth very oblique, the maxillary reaching center of pupil; nape nearer front of dorsal than end of snout. Anal spine comparatively small, about one-fifth length of head, transversely very convex in front, and slightly concave or grooved behind, the pouch of skin at its base little developed; pectorals very small, shorter than eye; anal fin beginning nearer tip of caudal than tip of snout by about 3 times length of head. Head 10; depth $9\frac{1}{2}$. D. LXXXIII; A. 35. L. 6 inches. Monterey to Puget Sound; abundant in rock-pools and bunches of *Fucus;* remarkable for its active movements.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 139.)

413.—ANOPLARCHUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1861, 261: type *Anoplarchus purpurescens* Gill.)

Body elongated, compressed, covered with very small, imbedded scales; lateral line obsolete. Head small, compressed; eyes small; mouth oblique; teeth in each jaw in one series, of nearly uniform size; no teeth on vomer or palatines; gill-membranes broadly attached to the isthmus; branchiostegals 5. Dorsal fin not very low; no anal spines; ventrals wanting; caudal fin small, entire; pectoral fins moderate; pyloric cœca present, few. Pacific. (ανοπλος, unarmed; αρχος, anus; the anal fin being without spines.)

1176. A. atropurpureus (Kittlitz) Gill.

Color grayish olive, varying to brown, everywhere above finely marked with blackish reticulations; along each side of back a series of small, irregular, sharply-defined grayish spots; a series of small pale spots along lateral line; belly pale; crest and middle line of back rather pale; under parts of head yellowish; an oblique, wedge-shaped, pale streak extending downward and backward from the eye, bounded on each side by a sharp light-red line, and then by a dusky area; lower jaw mottled; dorsals olivaceous, speckled, a blackish spot on front; anal olive, tinged with red; pectorals dull orange, barred at base; caudal reddish, with narrow pale streaks, and a light bar at base; color sometimes nearly plain purplish, but more often grayish and mottled. Head with a fleshy crest, which rests on a ridge of bone; its height in older specimens about equal to eye; mouth rather large, the maxillary reaching beyond the orbit. Pectorals about half the length of head; dorsal and anal comparatively high, barely connected with the base of caudal; nape midway between origin of dorsal and pupil. Head $6\frac{1}{3}$; depth $6\frac{3}{4}$. D. LVII; A. 41. Alaska to San Francisco; abundant northward.

(*Ophidium atropurpureum* Kittlitz, Denkwürd. einer Reise, Russ.-Amer. i, 225, 1858: *Centronotus cristagalli* Günther, iii, 289: *Anoplarchus purpurescens* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 261: *Anoplarchus cristagalli* Günther, iii, 564.)

1177. A. alectrolophus (Pallas) J. & G.

Brownish-olive, darker above; a series of green blotches along the dorsal; dorsal brownish-olive, with indistinct oblique bars; anal and caudal with wavy lines; head with a longitudinal fleshy crest, extending from above eyes to nape. Anal fin beginning at anterior third of body; dorsal and anal uniting with the caudal; pectorals very small; no ventrals. Lateral line obsolete. D. LXIII; A. 44; C. 13. Island of Talek, Gulf of Penshin. (*Cuv. & Val.*) Perhaps identical with the preceding.

(*Blennius alectrolophus* Pallas, Zoogr. Ross.-Asiat. iil, 174: *Gunnellus alectrolophus* C. & V. xi, 447: *Centronotus alectrolophus* Günther, iii, 289.)

414.—XIPHISTER Jordan.

(*Xiphidion* Girard; preoccupied in *Orthoptera*.)

(Jordan, Proc. U. S. Nat. Mus. 1879, 241: type *Xiphidion mucosum* Girard.)

Body elongate, eel-shaped, covered with small scales; lateral lines several, viz: one along the median line of the side, one above this, and one below it; one on each side of the abdomen, the two meeting in

front, and one from the occiput toward the base of the dorsal fin. Each of these has on each side, series of short branches, placed at right angles to the main line, those on opposite sides alternating. Each of these branches has about two open mucous pores. Head short, bluntish, scaleless; mouth moderate, oblique; jaws with rather strong teeth, the anterior canine-like; no teeth on vomer or palatines. Branchiostegals 6; gill-membranes separate, free from the isthmus. A single long, low, uniform dorsal fin, consisting of spines only; anal fin similar in form, with 2 small spines; caudal short, joined to dorsal and anal; no ventral fins; pectoral fins very small. Intestinal canal moderately elongate, with 4–6 well-developed pyloric cœca. Herbivorous, feeding on algæ. Active fishes, inhabiting tide-pools and crevices among rocks in the North Pacific. (*ξῐ́φιστήρ*, a sword-belt.)

1178. X. chirus Jordan & Gilbert.

Color olive-brown, yellowish below; sides with marblings of different shades of brown, sometimes with short blackish vertical bars; some round black spots along the back and sides; a black spot behind opercles; numerous black spots on sides of head, forming in older specimens light and dark streaks, which radiate from eye across cheeks and opercles, the pale streaks forming reticulations; dorsal with black spots, and a series of bright reddish-brown cross-blotches; pectorals and caudal plain. Head short; nape not constricted; mouth small; maxillary extending to middle of pupil; teeth strong, the anterior canine-like, bluntish; about 4 canines in lower jaw, 5 or 6 in the upper, similar to the teeth behind them, but somewhat larger. Abdominal lines meeting on the breast, but not connected with the lower lateral line. Dorsal fin beginning close behind pectoral; nape midway between middle of eye and front of dorsal; anal beginning about a head's length nearer snout than base of caudal; pectoral fin comparatively large, longer than the eye, its length about equal to distance between middle and lower lateral lines. Head 7; depth 9. D. LXX; A. II, 50. Monterey to Alaska; smaller than the other species, and living in deeper water.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 135.)

1179. X. mucosus (Girard) Jordan.

Blackish green, pale on belly and sides of head, marked posteriorly with olive-green in various pattern; a transverse light-greenish bar at base of caudal; 3 olive-brown streaks, radiating backward from eye, paler in the center and edged above and below with blackish, outside

of which is sometimes a streak of pale olive. These streaks all merge backward into the color of the head; middle streak broadly wedge-shaped; the third streak terminating before reaching margin of preopercle; old specimens often coarsely blotched with yellow. Lower jaw with a series of short stout conical teeth; upper jaw with a narrow band of similar teeth; 2 strong canines in upper jaw, 4 in the lower. Lower lateral line sending a branch to the abdominal line; nape not constricted. Dorsal beginning anteriorly; distance from its origin to occiput less than that from occiput to tip of snout; origin of anal nearer snout than tip of caudal by about half length of head; pectoral fin as long as eye. Head 8; depth $7\frac{1}{2}$. D. LXXIII; A. 48. L. 18 inches. Monterey to Alaska; very abundant among rocks and algæ.

(*Xiphidion mucosum* Girard, U. S. Pac. R. R. Surv. Fish. 1858, 119: *Xiphidion mucosum* Günther, iii, 291; Jordan & Gilbert. Proc. U. S. Nat. Mus. 1880, 137: *Xiphidium cruoreum* Cope, Proc. Amer. Phil. Soc. Phila. 1873.)

1180. X. rupestris Jor. & Gilb.

Reddish brown, uniform or variously shaded with lighter; a light olivaceous bar at base of caudal, extending on dorsal and anal; behind this a blackish area; tip of caudal usually pale; 3 long, well-defined stripes radiating backward from eye, these stripes uniform black, abruptly margined with very light olive; the central stripe proceeds straight backward from the eye, half the breadth of the cheeks, at which point it is broadest; it is then narrowed and bent abruptly downward; both the middle and lower stripes reach the margin of preopercle. Teeth essentially as in *X. mucosus*. The lower lateral line sends a branch to the abdominal line. A constriction at the nape. Distance from origin of dorsal to the occiput greater than the distance from the occiput to the snout. Anal fin beginning much in advance of middle of body, the distance from the first ray to tip of caudal exceeding the distance to snout by nearly twice length of head; pectoral very short, its length less than diameter of eye. Head 8; depth 9. D. LXVI; A. 50. L. 12 inches. Smaller than the preceding, and equally abundant; among rocks and algæ, from Alaska to Monterey.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 137.)

415.—CEBEDICHTHYS Ayres.

(Ayres, Proc. Cal. Acad. Nat. Sci. i, 59, 1855: type *Cebedichthys cristagalli* Ayres=*Apodichthys violaceus* Grd.)

Body comparatively short, compressed, covered with minute scales; lateral line distinct, running very high, with very short branches,

each ending in a pore, as in *Xiphister*, but the branches more oblique and less regular. Head short; crown with a conspicuous fleshy longitudinal crest in the adult; jaws subequal, with conical teeth; villiform teeth on vomer and palatines; gill-membranes united, free from the isthmus. Dorsal fin continuous, long and low, the anterior part composed of sharp spines, which are rather lower than the soft rays; caudal fin rounded, connected with dorsal and anal; anal fin similar to soft dorsal, with 1 or 2 small spines; pectorals small; ventrals wanting. Intestinal canal elongate, with several pyloric cœca. Pacific Ocean. Herbivorous, similar in habits to the species of *Xiphister*. (*κῆβος*, the Sapajou, a kind of monkey; *ἰχθύς*, fish; in allusion to the "peculiar monkey-like" physiognomy as seen from the front.)

1181. C. violaceus (Ayres) Grd.

Dull olive grayish, mottled with lighter, sometimes reddish tinged; vertical fins all edged with reddish; cheeks with 3 darker stripes, edged with paler, one downward and backward from the eye, close behind angle of mouth; another above it to root of pectoral; another running upward and backward from the eye, and meeting its fellow over the crest. Maxillary extending to or beyond orbit. Dorsal scaly at base; vent nearer snout than base of caudal; pectoral two-fifths length of head; nape midway between dorsal and eye. Head 6½; depth 6. D. XXIII, 41; A. I, 41. L. 30 inches. San Francisco to Point Concepcion; abundant.

(*Apodichthys violaceus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 150: *Cebedichthys cristagalli* Ayres, Proc. Cal. Acad. Nat. Sci. i, 58, 1855; Girard, U. S. Pac. R. R. Surv. Fish. 121; Günther, iii, 260.)

416.—EUMESOGRAMMUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1864, 210: type *Clinus præcisus* Kröyer.)

Body comparatively short, the back somewhat arched; mouth rather large, the jaws with villiform teeth; teeth on vomer and palatines. Scales small; lateral line present, median, with one or more accessory branches; pectorals and ventrals well developed. Dorsal moderately high, of spines only, slightly connected with the rounded caudal; gill-openings continued forwards below, the membranes narrowly joined to the isthmus; pyloric cœca present. (*εὖ*, well; *μέσος*, middle; *γραμμή*, line; the longest lateral line being the middle one.)

a. Lower lateral line present.

1182. E. præcisus (Kröyer) Gill.

An ovate, black, white-edged spot between the sixth and tenth dorsal spines. Snout subconical; cleft of mouth slightly oblique; vomerine

and palatine teeth present; 3 lateral lines on each side, the median continued to the base of the caudal; ventral fin half as long as the pectoral, which is much shorter than head; dorsal fin terminating just at root of caudal. Head 4; depth nearly 6. D. XLIX; A. 34; V. 3. Greenland. (*Günther.*)

(*Clinus præcisus* Kröyer, Naturh. Tidsskr. i, 25, 1836: *Clinus unimaculatus* Reinh. Vid. Selsk. vii, 114, 1837: *Stichæus unimaculatus* Günther, iii, 283; Gill, l. c. 210.)

aa. Lower lateral line wanting.

1183. E. subbifurcatus (Storer) Gill.

Brownish, with several round paler blotches above at the base of the dorsal fin; spaces between these blotches darker, appearing like bars; a broad black bar crossing the opercle obliquely from below the orbit, and two parallel dark bars running backwards from orbit; belly yellowish white; dorsal fin with numerous black dots. Mouth rather large; maxillary reaching to below orbit; back somewhat arched; ventral outline nearly straight; eyes large; lower lateral line wanting; upper branch of lateral line about two-thirds length of head. Head $4\frac{1}{3}$; depth nearly 5. D. XLIV; A. 30. North Atlantic, south to Cape Cod.

(*Pholis subbifurcatus* Storer, Rep. Fish. Mass. 1839, 63.)

417.—STICHÆUS Reinhardt.

(Reinhardt, Dansk. Vidensk. Natur. og Math. Afhandl. 1837, 109: type *Blennius punctatus* Fabricius.)

Body comparatively short and compressed, covered with small scales; teeth on jaws, vomer, and palatines. Lateral line present, single, median; pectorals and ventrals well developed. Dorsal moderately high, of spines only, free from the caudal; gill-openings continued forward below, the membranes narrowly united to the isthmus; pyloric cœca present. (στῐχάω, to set in rows.)

1184. S. punctatus (Fabric.) Kröyer.

Scarlet; dorsal with a series of round black spots, white-edged posteriorly; head below with 5 brownish cross-bands; a brown streak from snout through eye. Snout subconical. Dorsal spines of moderate length. Eye half interorbital width. Head $5\frac{1}{4}$ in total length; depth 8. D. XL; A. I, 35. (*Günther.*) Polar seas, south to Cape Cod and Alaska,

(*Blennius punctatus* Fabric. Faun. Grön. 153, 1780: Krõyer, Naturh. Tidsskr. i, 377, 1837; Günther, iii, 283.)

418.—NOTOGRAMMUS Bean.

(Bean, Proc. U. S. Nat. Mus. iv, 147, 1881: type *Stichæus rothrocki* Bean.)

This genus differs from *Stichæus* in the presence of a single lateral line along the base of the dorsal fin. It is known, however, from immature examples only. The caudal fin is emarginate, a character unusual in this family. (νῶτος, back; γραμμή, line.)

1185. N. rothrocki Bean.

Pale brown, with 3 series of paler spots, those of the median series usually longer and narrower than the others; a series of about 10 pale spots on median line of back, the anterior as large as eye; a dark stripe around snout to end of opercle; a very narrow dark stripe along base of dorsal, its lower margin seeming to mark the course of the superior lateral line. Body covered with minute scales; lateral line undeveloped (in the immature specimens known), apparently running close to outline of back. Teeth in the jaws, and apparently on vomer and palatines. Gill-membrane deeply cleft, free from the isthmus. Eye 4 in head, as long as the subconical snout; maxillary reaching front of pupil. Dorsal beginning above upper axil of pectoral; like the anal, connected by a low membrane with the caudal; caudal emarginate behind; ventrals short, close together, 3 in head, and not half as long as pectorals; longest dorsal spines half height of body. Head $4\frac{1}{2}$; depth 6. B. 6. D. XLVIII; A. I, 34; V. I, 4; P. 15; C. 21. Northern Alaska and Siberia.

(*Stichæus? rothrocki* Bean, Proc. U. S. Nat. Mus. iv, 146, 1881.)

419.—LUMPENUS Reinhardt.

(*Leptogunnellus* Ayres: *Leptoclinus* and *Anisarchus* Gill.)

(Reinhardt, Dansk. Vidensk. etc. 1837, 110: type *Blennius lumpenus* Fabr..)

Body greatly elongate, moderately compressed, covered with small scales; lateral line indistinct or obsolete. Head long; snout short; no cirri; eyes large, placed high; mouth moderate, with a single row of rather small, conical teeth on each jaw; teeth present on vomer or palatines; gill-openings prolonged forward below, very narrowly united anteriorly to the isthmus, not forming a free fold across it. Dorsal composed of numerous, sharp, flexible, rather high, spines; caudal fin long; anal many-rayed; pectorals large, more than half length of head; ventrals well developed, jugular, I, 3 or I, 4; intestinal canal long; pyloric cœca present; no air-bladder. Chiefly herbivorous. Northern seas. (*Lumpen*, a Danish name of some similar fish.)

a. Teeth on vomer and palatines; pectorals with the upper and middle rays shortened, shorter than the lower (*Leptoclinus** Gill.)

1186. L. maculatus (Fries) Nilss.

Yellowish; a series of 5 large dark spots along the base of the dorsal fin, between which are smaller and fainter spots; dorsal and caudal barred. Caudal fin truncate, free from dorsal and anal; ventrals half as long as head; pectorals large, about as long as head. Anterior rays of dorsal short and free. Teeth on vomer and palatines; lower jaw included; maxillary reaching middle of eye. Head 6. D. LX; A. 36. (*Collett.*) Greenland to Spitzbergen; occasional southward, in deep water.

(*Clinus maculatus* Fries Kgl. Vet. Ak. Handl. 1837, 49: *Clinus aculeatus* Reinh. Dansk. Vidensk. Selsk. Natur. Afhandl. vii, 114, 122, 194, 1838: *Stichæus maculatus* and *aculeatus* Günther, iii, 281; Collett, Norske Nord-Havs Exp. 1880, 67.)

aa. Teeth on jaws and palatines, none on vomer; pectorals with the middle rays longest, the lower ones shortened.

b. Anterior half of anal fin with the rays shortened. (*Anisarchus*† Gill.)

1187. L. medius (Reinh.) Kröyer.

Yellowish, nearly plain. Lower jaw scarcely included, the maxillary reaching front of eye; teeth on palatines, none on vomer; ventrals slender, one-third length of head; lower rays of pectoral shorter than middle ones, the fin shorter than head. Dorsal and anal slightly joined to the truncate caudal; anterior half of anal with the rays shortened. Head 6; depth 10. D. LXI; A. 42; V. I, 3. Greenland to Norway and Spitzbergen. (*Collett.*)

(*Clinus medius* Reinh. Dansk. Vidensk. Afhandl. 1838, 114: *Lumpenus medius* Kröyer, Naturh. Tidsskr. i, 377, 1837: *Stichæus medius* Günther, iii, 281: *Anisarchus medius* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 209; Collett, l. c. 62.)

bb. Anal rays subequal. (*Lumpenus.*)

1188. L. anguillaris (Pallas) Gill.

Olive green above, pale below; sides marked above with dark olive brown; a series of more or less distinct oblong blotches of olive brown along middle of sides; dorsal barred or spotted; anal pale; opercle with a dark blotch; head dusky above. Cheeks scaly; mouth somewhat oblique, the lower jaw included; maxillary reaching front of pupil; teeth on palatines, none on the vomer; sides of each jaw with 1 or 2 larger teeth. Gill-openings prolonged forward a distance greater than length of snout; pyloric cœca 4, unequal. Fins all comparatively

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*Gill, Proc. Acad. Nat. Sci. Phila. 1864, 209: type *Clinus aculeatus* Reinh. (λεπτός, slender; κλίνος, *Clinus.*)

†Gill, Proc. Acad. Nat. Sci. Phila. 1864, 209: type *Clinus medius* Reinh. (ανισος, unequal; αρχὸς, anus.)

high; pectorals two-thirds length of head, the middle rays longest; ventrals one-third length of head. Dorsal and anal distinct from the pointed caudal, which is nearly as long as head. Head 8; depth 14. D. LXXI; A. 46; V. I, 4; B. 7. L. 18 inches. San Francisco to Alaska; very abundant northward.

(*Blennius anguillaris* Pallas, Zoogr. Ross.-Asiat. iii, 176, 1811: *Leptogunnellus gracilis* Ayres, Proc. Cal. Acad. Nat. Sci. i, 26: *Lumpenus anguillaris* Girard, U. S. Pac. R. R. Surv. Fish. 123: *Stichæus anguillaris* Günther, iii, 282.)

1189. L. fabricii (Cuv. & Val.) Kröyer.

Light brown, clouded with darker. Upper jaw scarcely longer than lower. Vertical fins separate; pectorals large; ventrals very slender. Depth 14. D. LXIII; A. 41; V. I, 3. Greenland. (*Cuv. & Val.*)

(*Blennius lumpenus* Fabricius, Fauna Grönl. 151: *Gunnellus fabricii* Cuv. & Val. xi, 431: *Stichæus lumpenus* Günther, iii, 280.)

420.—LEPTOBLENNIUS Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1860, 21: type *Blennius serpentinus* Storer.)

Body greatly elongate, covered with small scales; head rather slender; teeth very small, in a single series in each jaw; none on the vomer or palatines. No lateral line; no cirri; gill-openings somewhat prolonged forwards, narrowly united to the isthmus. Dorsal fin very long, continuous, of spines only; ventrals well developed, of 1 spine and 2 or 3 rays; pyloric cœca present. This genus is hardly worthy of separation from *Lumpenus*. (λεπτὸς, slender; Blennius.)

a. Dorsal spines 60–65. (*Centroblennius* Gill.*)

1190. L. nubilus (Rich.) J. & G.

Pale olive, marbled with darker. Upper jaw slightly longest; no teeth on vomer or palatines. Vertical fins not continuous; ventrals slender, one-third length of head; pectoral fin ovate, the middle rays longest. D. LXIII; A. 43; V. I, 4. Wellington Sound. (*Richardson.*)

(*Lumpenus nubilus* Rich. Last Arctic Voyage, Fish. 13, pl. 28: *Stichæus nubilus* Günther, iii, 564: *Centroblennius nubilus* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 209.)

aa. Dorsal spines 70–80. (*Leptoblennius* Gill.)

1191. L. serpentinus (Storer) Gill.

Olive above, with lighter cloudings; pale below; dorsal fin brownish, with broad, oblique, white bands; pectorals pale. Head not large, its sides sparsely covered with small scales; eye as long as snout; maxillary reaching front of pupil; gill-openings extending forward below, for a distance less than length of snout; pectorals long, seven-eighths

*Gill, Proc. Acad. Nat. Sci. Phila. 1860, 21: type *Lumpenus nubilus* Rich.

length of head; ventrals moderate, $2\frac{2}{3}$ in head. Head 9; depth 15. D. LXXV; A. 50; V. I, 3. L. 12 inches. Cape Cod to Greenland.

(*Blennius serpentinus* Storer, Proc. Bost. Soc. Nat. Hist. iii, 30, 1848; Gill, Proc. Acad. Nat. Sci.' Phila. 1864, 209.)

1192. L. lampetræformis (Walb.) J. & G.

Yellowish, with numerous brown spots of different sizes; caudal banded. No teeth on vomer or palatines; maxillary reaching front of eye. Caudal free, acuminate; first three or four rays of dorsal short and almost free; pectoral convex, shorter than head; vent well forward. Head 9. D. LXXII; A. 50; V. I, 3. (*Collett.*) Greenland to Norway and Spitzbergen.

(*Blennius lampetræformis* Walbaum, Artedi, Pisc. 1792, 184: *Clinus nebulosus* Nilss. Skand. Faun. 1855, 195: *Stichæus islandicus* Günther, iii, 281: *Blennius gracilis* Stuwitz. Nye Magaz. f. Naturv. i, 406, 1838: *Clinus nebulosus* Fries Vet. Akad. Handl. 1837, 55: *Leptoblennius gracilis* Gill, l. c. 210: *Lumpenus lampetræformis* Collett, Norske Nordhavs Exp. 1880, 71.)

421.—DELOLEPIS Bean.

(Bean, Proc. U. S. Nat. Mus. 1882: type *Delolepis virgatus* Bean.)

Body anguilliform, moderately compressed posteriorly, covered with small, imbricated, cycloid scales; vent nearly median; a small anal papilla; lateral line continuous, straight, nearly median, composed of open pores, without prominent tubes. Head oblong, subquadrangular, naked, the muciferous channels well developed, the vertex shallow-concave; snout short, obtuse; nostril single, tubular, close behind premaxillary; eyes small, high, separated by an interspace of moderate width, surrounded by a series of shallow pits; mouth wide, oblique, terminal, the lower jaw projecting beyond the upper; lips fleshy; premaxillaries slightly protractile, with 2 rows of small conical teeth; a few larger teeth at the symphysis; vomer and palatines with a few rather large teeth; tongue smooth, adherent; mandible with a few shallow pits, the series continued on the posterior border of preopercle; opercles unarmed. Gill-membranes attached to a narrow isthmus; gill-rakers very short; pseudobranchiæ present. Branchiostegals 6. Pectorals short, placed low, their bases vertical; ventrals none; dorsal beginning above gill-opening, composed entirely of spines; anal with 2 spines and many split rays; dorsal and anal continuous with the caudal, which is rather long and pointed. Intestine short, with a few pyloric cœca. (δῆλος, visible; λέπις, scale.)

1193. D. virgatus Bean.

Brownish yellow; a brown stripe along lateral line; another along

back; a third along base of anal. Width of head equal to greatest depth of body; interorbital area equal to snout, or one-third length of mandible; maxillary reaching a little behind eye, its length 3 in distance from snout to front of dorsal; eye 2 in snout, 11 in head. Beginning at a short distance behind origin of dorsal, small, oblong, cycloid scales, closely imbricated, cover a strip of the body along the lateral line; the scaled area gradually widens backward until, behind the vent, only a very narrow strip along bases of dorsal and anal is naked. Dorsal beginning over upper angle of gill-opening; first spine half as long as the seventy-first or longest; caudal 11 in length; pectoral 3 in head. Head 6; depth 10. D. LXXVI; A. II, 46; P. 13; cœca 6. L. 30 inches. Coasts of British Columbia and Alaska. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. 1882)

422.—CRYPTACANTHODES Storer.

Wry-mouths.

(Storer, Rept. Fish. Mass. 1839, 28: type *Cryptacanthodes maculatus* Storer.)

Body very long and slender, compressed, naked; lateral line obsolete; head oblong, cuboid, with vertical cheeks; conspicuous muciferous channels in mandible and preopercle; head flattish above, with deep rounded pits between and behind eyes; mouth large, very oblique; lower jaw very heavy, its tip projecting; premaxillary not protractile; jaws with rather sharp, conical teeth; larger teeth on the vomer and palatines; most of the teeth in single series. Gill-membranes joined to the isthmus; the gill-openings prolonged forwards below; pyloric cœca 5. Dorsal fin long, composed entirely of spines, which are rather strong, but enveloped in the skin; dorsal and anal joined to the caudal; no ventral fins; pectorals short. Size rather large; one species known. (*κρυπτὸς*, hidden; *ακανθόδης*, spined.)

1194. C. maculatus Storer.—*Wry-mouth; Ghost-fish.*

Light brownish, with several series of smallish dark spots, arranged in more or less regular rows, from the head to the base of the caudal; vertical fins closely spotted with darker; head above thickly speckled; body sometimes ("*inornatus*") entirely immaculate. Eyes small, placed high, not so wide as the interorbital space, which has 2 ridges and 3 pits; orbital rim raised; 2 deep pits behind eye at the temples; a deeper pit on the top of head between them; a raised ridge continued backward on each side of head behind orbital rim; maxillary extending to beyond eye; pseudobranchiæ small; pectorals short, 3 in

head, their tips reaching beyond front of dorsal; vent a little in front of middle of body. Head 6½; depth 13. D. LXXIII; A. 50. North Atlantic, south to Cape Cod; not very common.

(Storer, Rept. Fish. Mass. 1839, 28; Günther, iii, 291: *Cryptacanthodes inornatus* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 332, albino form.)

423.—ANARRHICHAS Linnæus.

Wolf-fishes.

(Artedi; Linnæus, Syst. Nat.: type *Anarrhichas lupus* L.)

Body moderately elongate, covered with rudimentary scales; head scaleless, without cirri, compressed, narrowed above, the profile strongly decurved; mouth wide, oblique; premaxillary not protractile; jaws with very strong conical canines anteriorly; lateral teeth of lower jaw either molar or with pointed tubercles; upper jaw without lateral teeth; vomer extremely thick and solid, with 2 series of coarse molar teeth; palatines with 1 or 2 similar series. Gill-membranes broadly joined to the isthmus; no lateral line. Dorsal fin rather high, composed entirely of flexible spines, which are enveloped in the skin; anal fin lower; caudal fin developed, free from dorsal and anal; no ventral fins; pectoral fins broad, placed low; air-bladder present; no pyloric cœca. Northern seas. (*Anarrhichas* (or *Scansor*), an ancient name of *A. lupus;* from *αναρριχάομαί*, to climb or scramble up; the allusion not evident.)

1195. A. lupus Linn.—*Wolf-fish.*

Brownish; sides with numerous (9–12) very dark transverse bars, which are continued on the dorsal fin, besides numerous dark spots and reticulations; fins dark; caudal tipped with reddish. Maxillary reaching beyond orbit; band of vomerine teeth extending much farther back than the short palatine band. Pectorals large, rounded, two-thirds length of head. Dorsal high, beginning over the gill-opening, its longest rays about half length of head. Head 6; depth 5½. D. LXII; A. 42. North Atlantic; rather common both in America and Europe.

(Linnæus, Syst. Nat. i, 430, 1766: Günther, iii, 208; Bean, Proc. U. S. Nat. Mus. ii, 1879, 217: *Anarrhichas vomerinus* Storer, Hist. Fish. Mass. 1867, 99, the American form.)

1196. A. minor Olafsen.

Sides without vertical bars, but with many large, round, black spots. Vomerine teeth extending nearly or quite as far back as the palatines. (*Bean.*) North Atlantic.

(Olafsen, Reise i Island, 1772, 592: *Anarrhichas pantherinus* Zouiew, Nov. Act. Petrop. 1781, 271; Bean, Proc. U. S. Nat. Mus. ii, 217, 1879.)

1197. A. latifrons Steenstrup & Hallgrimsson.

Brown, obscurely spotted with darker; the sides without dark bars. Head broad, the profile not strongly decurved; teeth much smaller; vomerine teeth not extending nearly as far back as the palatine series. Pectorals three-fifths length of head; dorsal fin not very high, beginning above the gill-opening, the longest spine less than half head; caudal $2\frac{1}{2}$ in head. Head 5; depth 4. D. LXVII; A. 45. (*Collett.*) North Atlantic.

(Steenstrup & Hallgrimsson, Förh. Skand. Naturf. 3 die Möte, 1842, 647; Bean, Proc. U. S. Nat. Mus. ii, 218, 1879; Collett, Meddelsk. Norges Fiske, 1879, 46.)

1198. A. lepturus Bean.

Dark brown, without bands or spots; belly pale, clouded with very dark brown. Head moderate; maxillary half as long as head; 4 large canines in the upper jaw and 5 in the lower, all of them strongly recurved; behind the canines in each jaw are a few sharp, conical teeth, also recurved; palatine teeth in 2 series, 4 in the outer and 5 in the inner series, those in the outer series the longer; vomerine teeth in 2 series, the vomerine patch beginning in advance of the palatine, and extending farther back than the latter; head and fins scaleless; median line of body, and all of tail with small, widely-separated scales. Head $4\frac{1}{2}$; depth 5. D. LXXXI; A. 52. (*Bean.*) Alaska.

(Bean, Proc. U. S. Nat. Mus. ii, 212, 1879: ?? *Anarrhichas orientalis* Pallas, Zoogr. Ross.-Asiat. iii, 77, 1811.)

424.—ANARRHICHTHYS Ayres.

(Ayres, Proc. Acad. Nat. Sci. i, 32, 1855: type *Anarrhichthys ocellatus* Ayres.)

Body elongate, tapering backward into a very long and compressed tail, around which the dorsal and anal are confluent with the caudal. Scales rudimentary; no lateral line. Dorsal high, composed entirely of flexible spines; pectoral fins broad, placed low; no ventral fins. Head very large, compressed, the snout rather short; mouth large; jaws with very strong, conical canines anteriorly; vomer and palatines each with about 2 rows of coarse molars, the palatine band shutting against similar teeth on the sides of the lower jaw. Gill-membranes broadly united to the isthmus. No pyloric cœca. Large fishes of the North Pacific. (*ἀναρριχας, Anarrhichas; ἰχθύς*, fish.)

1199. A. ocellatus Ayres.

Dark grayish or greenish, the body and dorsal fin everywhere covered with round, ocellated black spots of various sizes, the light mark-

ings forming reticulations around the spots; head paler, with the reticulations in much finer pattern; anal pale-edged. Pectorals broad, more than half length of head. Longest spines of dorsal half length of head. Head 11; depth 15. D. CCL; A. 233; P. 19. L. 5–8 feet. Pacific coast, from Monterey north to Puget Sound. Feeds largely on Echinoids.

(Ayres, Proc. Cal. Acad. Nat. Sci. i, 31, 1855: *Anarrhichthys felis* Girard, U. S. Pac. R. R. Surv. Fish. 1858, 125: *Anarrhichthys felis* Günther, iii, 211.)

Family CXV.—LYCODIDÆ.*

(*The Eelpouts.*)

Body elongate, more or less eel-shaped, naked or covered with very small, imbedded, cycloid scales; head large; mouth large, with conical teeth in jaws, and sometimes on vomer and palatines; bones of head unarmed. Gill-membranes broadly united to the isthmus; pseudobranchiæ present; gills 4, a slit behind the fourth. Dorsal and anal fins very long, of soft rays only, or the former with a few posterior spines; vertical fins confluent around the tail; pectorals small; ventrals jugular, very small or wanting. Lateral line obsolete or nearly so. Gill-rakers small; pyloric cœca rudimentary; vent not near the head. Genera about 6; species 30. Bottom fishes, chiefly of the Arctic and Antarctic seas; some of them, and perhaps all, are viviparous.

(*Lycodidæ* Günther, iv, 319–326: genus *Zoarces* Günther, iii, 295: *Zoarchidæ* Swainson.)

a. Dorsal fin low behind, some of its posterior rays short and spine-like; ventrals small. (*Zoarcinæ.*)
  b. Scales present; teeth strong, conic, in jaws only ..... Zoarces, 425.
aa. Dorsal fin continuous. (*Lycodinæ.*)
  c. Ventral fins present.
    d. Vomer and palatines toothless; scales present ..... Lycodopsis, 426.
    dd. Vomer and palatines with teeth.
      e. Scales present ..... Lycodes, 427.
      ee. Scales obsolete ..... Lycodalepis, 428.
  cc. Ventral fins wanting.
    f. Jaws equal; body scaleless ..... Gymnelis, 429.
    ff. Jaws unequal, the lower projecting ..... Uronectes, 430.

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*The six families following (*Lycodidæ, Congrogadidæ, Fierasferidæ, Ophidiidæ, Gadidæ, Macruridæ*) constitute the group or suborder of *Anacanthini* or *Jugulares*, distinguished from the other *Acanthopteri* by the long dorsal and anal fins, which are composed of soft rays only. The ventral fins, if present, are jugular. The present family is called *Zoarcidæ* in the key, on page 79.

425.—ZOARCES Cuvier.

Eelpouts.

(Cuvier, Règne Anim. ed. 2, ii, 240, 1829: type *Blennius viviparus* L.)

Body elongate, compressed, tapering posteriorly; head oblong, heavy, narrowed above, the profile decurved; mouth large; teeth strong, conic, bluntish, in 2 series in the front of each jaw, and 1 series on the sides; teeth in outer series larger; no teeth on vomer or palatines. Dorsal fin very long, low, some of its posterior rays much lower than the others, developed as sharp spines; pectoral fins broad; ventrals jugular, of 3 or 4 soft rays. Scales small, not imbricated, imbedded in the skin. Size large. (ζώαρκής, viviparous.)

a. Numbers of fin rays and vertebræ increased. (*Macrozoarces* Gill.)

1200. Z. anguillaris (Peck) Storer.—*Eelpout; Mutton-fish; Mother of Eels.*

Reddish brown, mottled with olive, the scales paler than the skin about them; dorsal fin marked with darker; a dark streak from eye across cheeks and opercles; lower jaw included; maxillary reaching beyond orbit; pectoral long, about two-thirds length of head; ventrals one-fifth head; highest ray of dorsal about equal to snout; the posterior spines about one-third length of eye; first ray of dorsal above preopercle. Head 6; depth 7. D. 95, XVIII, 17; A. 105. L. 20 inches. Delaware to Labrador; rather common northward. Two forms, perhaps distinct species (*anguillaris*, *ciliatus*) occur, distinguished by the size of the jaws.

(*Blennius anguillaris* Peck, Mem. Amer. Acad. Sci. ii, 46; Storer, Fish. Mass. 263; Günther, iii, 296: *Enchelyopus anguillaris* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 258: *Zoarces labrosus* and *Z. fimbriatus* Cuv. & Val. xi, 466, 468: *Blennius ciliatus* Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 375, 1815, the large-mouthed form.)

426.—LYCODOPSIS Collett.

(*Leurynnis* Lockington.)

(Collett, Proc. Zoöl. Soc. London, 1879, 381: type *Lycodes pacificus* Collett.)

Body elongate, eel-shaped, covered with small, smooth, imbedded scales. Head large; snout broad and long; interorbital space very narrow; mouth large, horizontal; teeth conical, those of the upper jaw in a single row; those of the lower in a band in front, the inner series enlarged, larger than the upper teeth; no teeth on vomer or palatines. Ventral fins very small; vertical fins continuous, without spines. (λύκώδης, Lycodes; ὄψις, appearance.

1201. L. pacificus Collett.

Light-reddish olive, becoming lighter below; vertical fins margined with black; the scales paler than skin, forming light spots; pectorals dusky. Head comparatively short; orbital region not constricted, nor cheeks tumid; mouth comparatively small, the maxillary reaching center of pupil; head, nape, and axil of pectoral naked. Dorsal and anal fins enveloped in thick skin, which is covered with imbedded scales like those on the body; pectoral half the length of head; ventrals half length of orbit; mandible half length of head; distance from snout to base of dorsal, $4\frac{1}{2}$ in length. Head $5\frac{1}{2}$; depth $8\frac{1}{2}$. D. 100; A. 85. L. 12 inches. San Francisco to Puget Sound; rather common in deep water; the original type said to be from Japan.

(*Lycodes pacificus* Collett, Proc. Zoöl. Soc. London, 1879, 381.)

1202. L. paucidens (Lockington) Gill.

Very similar to *L. pacificus*, but larger, with larger head and mouth; snout very broad; orbital region constricted; cheeks tumid; maxillary extending about to posterior edge of orbit. Pectoral two-fifths length of head; ventrals half orbit; mandible three-fifths length of head; distance from snout to base of dorsal, $3\frac{3}{4}$ in length. Head $4\frac{1}{2}$; depth 10. Off San Francisco in deep water; possibly a variety or state of the preceding, corresponding to the "variety" *ciliatus* of *Zoarces anguillaris*.

(*Leurynnis paucidens* Lockington, Proc. U. S. Nat. Mus. 1879, 326; Gill, Proc. U. S. Nat. Mus. 1880, 248.)

427.—LYCODES Reinhardt.

(Reinhardt, Kongl. Danske Vidensk. Selsk. Naturv. vii, 153, 1838: type *Lycodes vahli* Reinh.)

Body elongate, more or less eel-shaped, tapering behind. Head oblong; mouth nearly horizontal; lower jaw included; conical teeth on jaws, vomer, and palatines, those on jaws and palatines mostly in a single series. Dorsal fin beginning behind bases of pectorals, without spines; pectorals moderate, inserted rather high; ventral fins small, of 3 or 4 rays. Scales small and imbedded, present on part or all of the body, the scaly area more extensive in the adult than in the young. No air-bladder nor pyloric cœca. Species numerous, chiefly of the Northern seas. (λύκώδης, wolfish.)

a. Body elongate, its depth 12–24 times in length.

1203. L. paxillus Goode and Bean.

Color probably light brown. Body very elongate; head broad, flat

above, the profile abruptly decurved; upper jaw extending far beyond the lower; cheeks very full and protuberant; teeth of both jaws in a single series except at the symphysis; a few teeth clustered at the head of the vomer; palatines with a single series; teeth very stout, recurved and sharply pointed; scales covering the entire body and extending on the bases of the vertical fins; head and pectoral fins scaleless; dorsal fin inserted at less than one-fourth the entire length from the snout. Head 7; depth 17. D. 116; A. 100. (*Goode & Bean.*) Le Have Banks.

(Goode & Bean, Proc. U. S. Nat. Mus. 1879, 44.)

1204. L. verrilli Goode & Bean.

Light grayish brown above; below, pearly white; sides with irregular brown patches bisected by the lateral line; abdominal region livid blue; a spot of brown on the tip of tail. Body very elongate. Head much depressed; maxillary nearly reaching posterior margin of orbit; upper jaw much the longer; profile very convex, snout obtusely rounded above. Head $5\frac{2}{3}$; depth about 13. D. 92; A. 88. (*Goode & Bean.*) Coast of Massachusetts and northward, in deep water.

(Goode and Bean, Amer. Journ. Sci. Arts, xiv, 1878, 474.)

aa. Body moderately elongate, its depth 6–10 times in the length.

1205. L. vahli Reinhardt.

Brownish yellow, with 6 blackish cross-bands extending on the dorsal fin and confluent on the belly; the first cross-band on and below the anterior dorsal rays, the second above the vent; adults nearly uniform blackish. Head nearly twice as long as high; snout long, the maxillary reaching to opposite middle of eye; distance of vent from ventrals nearly equal to length of head; ventral fins less than one-fourth as long as pectorals; vertical fins scaly; body wholly scaly. Head $4\frac{1}{3}$; depth 8. D. 116; A. 93; V. 4; vert. 25 + 87. North Atlantic. (*Günther.*)

(Reinhardt, Dansk. Vidensk. Selsk. Afhandl. vii, 153, 1838; Günther, iv, 319; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 260.)

1206. L. esmarki Collett.

Brownish black, with a whitish-yellow patch on the nape, and 5–8 transverse bands of the same color across the dorsal and posteriorly across the anal, these bands becoming broken into annular spots, with age. Body behind front of dorsal scaled; vertical fins scaly; nape scaly; snout obtuse; maxillary not more than half head; lateral line indistinct, divided; pectorals 8 in length. Head $4\frac{1}{2}$; depth 8. D. 110;

A. 95; P. 22; V. 4. Nova Scotia to Finmark and Spitzbergen. (*Collett.*)

(Collett, Norges Fiske 1874, 95; Collett, Norske Nord-Havs Exp. 1880, 84: *Lycodes rahli* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 209, not of Reinh.)

1207. L. reticulatus Reinh.

Brownish, with reticulated black lines on the head and body; those on the body disposed in 5 groups or cross-bands, the three anterior of which emit 1 or 2 vertical streaks on the dorsal fin; dorsal dark-edged. Body entirely scaly; vertical fins naked. Head twice as long as high; snout long; maxillary extending to behind middle of eye; distance from vent to ventrals more than length of head. Head 4; depth about 8. D. 94; A. 75; V. 4; cœca 2. L. 14 inches. Greenland, south to the Grand Banks.

(Reinhardt, l. c. 167; Günther, iv, 320; Gill, l. c. 260; Collett, l. c. 84: *Lycodes rossi* Malmgr. 1864: *Lycodes gracilis* Sars, Christ. Vid. Selsk. Forh. 1866: *Lycodes perspicillum* Kröyer, Dansk. Vidensk. Selsk. Afhandl. 1845, 233: *Lycodes perspicillum* Günther, iv, 320: *Lycodes perspicillum* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 260.)

1208. L. seminudus Reinh.

Color uniform pale grayish brown, without spots or bands. Body naked in front of vent, scaly behind; fins naked. Head large. Distance of ventrals from vent somewhat more than length of head. Head $3\frac{1}{2}$; depth 7. D. 91; A. 74; P. 21; cœca 2. Greenland to Spitzbergen. (*Collett.*)

(Reinhardt, Kong. Dansk. Selsk. etc. 1838, 223; Günther, iv, 320; Gill, l. c. 260; Collett, l. c. 113.)

1209. L. nebulosus Kröyer.

Brown, with small, faint, yellow, transverse bands across the back Body naked anteriorly; the posterior part of dorsal fin scaly; the anal naked or nearly so. D. 87; A. 68; P. 19; V. 3. Greenland. (*Kröyer.*) An imperfectly-described species, unknown to recent writers.

(Kröyer, l. c. 1844, 140; Gill, l. c. 260.)

1210. L. coccineus Bean.

Brown, red below; pectorals reddish brown above, carmine below; 9 bluish-white bands on the dorsal; a few whitish blotches on sides and on head; anal brownish red; head white below; a whitish blotch as large as eye at upper angle of gill-opening. Posterior two-thirds of tail covered with separated scales; rest of body, head, and fins, scaleless; lateral line visible only on scaly part of body, consisting of a few faint, short, linear scratches. Pectoral twice as long as premaxillary, falling short of the vent by its own length; dorsal beginning over

anterior half of pectoral; anal under twenty-first dorsal ray; tail stout. Head 4; depth $7\frac{1}{2}$; B. 6. D. 87 (with half of caudal); A. 87 (with half of caudal); P. 18; V. 3. L. 20 inches. Big Diomede Island, Bering's Strait. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. iv, 144, 1881.)

428.—LYCODALEPIS Bleeker.

(Bleeker, Verl. Akad. Amst. ed. 2, viii, 369: type *Lycodes mucosus* Rich.)

This genus differs from *Lycodes* in the total absence of scales. (*λυκώδης*, *Lycodes*; *αλεπις*, without scales.)

1211. L. mucosus (Rich.) Bleeker.

Blackish, with irregular white markings in the form of 5 narrow bars across the back; lower parts of head and trunk whitish. Body robust; head very large; snout long, its length 3 in head; mouth large, the maxillary extending to beyond eye; distance from vent to ventrals more than length of head; eye very small, 11 in head. Ventrals very small; pectorals large and broad. Head $3\frac{4}{7}$; depth 8. D. 90; A. 70; V. 3; vert. 26 + 66; cœca 2. L. 18 inches. Arctic seas.

(*Lycodes mucosus* Rich. Last Arctic Voyage, 362: *Lycodes mucosus* Günther, iv, 320: *Lycodes mucosus* Bean, Bull. U. S. Nat. Mus. xv, 112, 1879.)

1212. L. turneri (Bean) J. & G.

Light brown, grayish below; a cream-colored band on anal; a crescentic band of cream-color crosses the nape, and continues behind the pectorals; 10 bands of cream-color, bordered with brown, from the tips of the dorsal rays to the lower half of body, becoming wider, and broken below the middle; caudal tipped with pale. Head depressed; maxillary reaching to opposite posterior margin of eye; distance from ventrals to vent less than length of head. Head $4\frac{1}{5}$; depth 8. D. 85; A. 67; P. 18; V. 3. Saint Michael's, Alaska. (*Bean.*)

(*Lycodes turneri* Bean, Proc. U. S. Nat. Mus. 1878, 463.)

1213. L. polaris (Sabine) J. & G.

"Without any scales; length of the pectoral exceeding twice its breadth, having 15 rays. Yellowish, lighter on the belly, with 11 large saddle-like markings across the back, the middle of these markings being much lighter than their edges; the whole back and the sides marbled." (*Günther.*) Coast of North Georgia. An imperfectly described species, unknown to late writers.

(*Blennius polaris* Sabine, Parry's Journ. Voy. 1819–'20, Suppl. 212: *Lycodes polaris* Günther, iv, 321.)

429.—GYMNELIS Reinhardt.

(Reinhardt, Dansk. Vidensk. Selsk. Afhandl. vii, 131, 1838: type *Ophidium viride* Fabricius.)

Body elongate, naked (see *G. stigma*). Vertical fins without spines; ventral fins none. Small conical teeth on the jaws, vomer and palatines. Gill-openings very narrow. No air-bladder; pyloric cœca none; no anal papilla. Size small. Arctic seas. (γυμνος, naked; εγχελυς, eel.)

1214. G. viridis (Fabr.) Reinh.

Brownish, sometimes uniform, but generally with dark roundish transverse markings; 1 to 4 round black spots on anterior part of dorsal fin; anal sometimes black-edged; lower part of head with sharply-defined whitish markings. Snout subconical, longer than the eye; jaws equal; mouth oblique; maxillary reaching beyond eye; teeth rather small, conical, in a single series on each side, forming a patch anteriorly; distance from snout to vent $2\frac{1}{3}$ times length of head. Pectoral rounded, inserted low, its length less than half that of head. Dorsal commencing over posterior third of pectorals. Head about $6\frac{1}{2}$; depth about 13. Eye 7 in head. D. 100; A. 80. Arctic seas, Alaska to Nova Scotia; abundant.

(*Ophidium viride* Fabr. Faun. Grœnl. 141, 1780; Günther, iv, 323; Collett, l. c. 123: *Gymnelis pictus* Günther, iv, 324, 1862.)

1215. G. ? stigma (Bennett.) Gthr.

Scales present, very small; no trace of ventrals. Dilute brown, with irregular transverse series of brown spots, besides obscure cross-bands ("void swathes"); a large, round, purplish spot near the origin of the dorsal. Vertical fins united into a transparent ridge; pectoral rather large. Snout obtuse; chin with a large gibbosity; teeth small. Depth about 8. L. 5 inches. Kotzebue Sound. (*Lay.*) Probably the type of a distinct genus.

(*Ophidium stigma* Lay & Bennett, Zoöl. Beechey's Voy. 67; Günther, iv, 325.)

430.—URONECTES Günther.

(Günther, Cat. Fish. Brit. Mus. iv, 325, 1862: type *Ophidium parrii* Ross.)

Body ensiform, compressed; tail long and tapering; ventrals none; vent not far distant from the head; numerous minute teeth in jaws and on palate; lower jaw the longer; no barbel; scales and gill-openings unknown. (ουρά, tail; νηκτης, swimmer.)

1216. U. parrii (Ross) Gthr.

Color uniform. Head very obtuse, its length, depth, and breadth equal; head broader than the body, flattened and grooved between the

eyes, which are lateral and rather large; greatest depth of body somewhat more than length of head; neck much arched. Dorsal inserted just behind head; pectoral extending beyond vent. Head 4. D. 50; A. 45; P. 37. Baffin's Bay. (*Günther.*)

(*Ophidium parrii* Ross, Parry's Third Voyage, App. 109; Günther, iv, 326.)

Family CXVI.—CONGROGADIDÆ.

Body elongate, compressed, eel-shaped, naked or covered with small scales. Mouth moderate, horizontal, the lower jaw the longer; teeth in a single series in the jaws and sometimes on vomer and palatines also; no barbels. Branchiostegals 4 to 7; gills 4, a slit behind the fourth; pseudobranchiæ present. Gill-membranes more or less connected, free from the isthmus. Dorsal fin long and low, of slender rays imbedded in the skin; anal similar to dorsal, both connected to the caudal fin; tail diphycercal. Pectoral fins small; ventral fins wanting. Vent remote from the head, without papilla. Air-bladder none; pyloric cœca none. Small fishes, chiefly of the East Indies. Genera 3; species 4.

(*Ophidiidæ*, group *Congrogadina* Günther, iv, 388, 389.)

a. Canines present; dorsal beginning near the middle of the body...Scytalina, 431.

431.—SCYTALINA Jordan & Gilbert.

(Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 266: type *Scytalina cerdale* J. & G.)

Body very long and slender, covered with small scales. Head depressed, shaped like the head of a snake, with tumid cheeks and a distinct neck. Eyes small, superior. Mouth rather large, the lower jaw slightly projecting. Teeth conic, in single series on jaws, vomer, and palatines. Each jaw with two canines in front. No lateral line; pseudobranchiæ small. Gill-rakers almost obsolete. Dorsal fin very low, its first ray near the middle of the body. Anal fin similar to dorsal, nearly as long. Tail diphycercal, the caudal well developed. (Diminutive of *Scytale*, from σκυταλη, a viper.)

1217. S. cerdale J. & G.

Flesh-colored, with much mottling of purplish in fine pattern; belly nearly plain; caudal reddish-edged. Head broader than body; snout depressed, rounded at tip; cheeks very long; opercle short; interorbital space rather broad, concave posteriorly; eyes small, anterior and superior; upper lip separated by a crease from the skin of the forehead; lower jaw projecting; edge of lower lip with pores, and small dermal flaps and fringes; maxillary extending a little beyond eye; nostrils with small flaps. Lower jaw with a series of close-set, even,

conical teeth, besides two divergent canines in front; upper jaw with similar teeth in several series in front, the canines smaller and closer together. Pectorals little longer than eye; insertion of dorsal slightly in front of anal, a little in front of middle of body; rays of vertical fins low and weak, those of caudal most developed; vent close in front of anal, which is similar to dorsal. Head 8; depth 14. D. 41; A. 36. L. 6 inches. Straits of Fuca; burrowing among rocks near low tide-mark.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. iii, 1880, 266.)

Family CXVII.—FIERASFERIDÆ.

Body very elongate, compressed, tapering into a long and slender tail. No scales. Teeth cardiform on jaws, vomer, and palatines; canine teeth often present; no barbels; lower jaw included; vent at the throat; gill-membranes more or less united, free from the isthmus; no pseudobranchiæ; no pyloric cœca; vertical fins very low, confluent, without spines; no ventral fins; pectoral fins present or absent. Small fishes of the tropical seas, parasitic in shells of mollusks, in *Echinoderms*, etc. Genera 3; species 12.

(*Ophidiidæ*, group *Fierasferina* Günther, iv, 381–384.)

a. Pectoral fins present; caudal fin obsolete ..... Fierasfer, 432.

432.—FIERASFER Cuvier.

(Cuvier, Règne Anim. ii, 1817: type *Fierasfer imberbis* Cuv. = *Gymnotus acus* Brünnich.)

No distinct caudal fin; pectoral fins developed. (*Fierasfer*, the ancient name, from *ψιερός*, sleek and shining.)

1218. F. dubius* Putnam.

Color, in spirits, uniform light brown, with a short silvery band along the sides of the abdomen, made by confluent spots. Maxillary extending slightly beyond orbit; lower teeth larger than the upper, except 2–4 front teeth of upper jaw, which are about equal to lower teeth; vomer with 3–6 teeth, 2 or 3 of these canine-like. Pectoral half head; vent under base of pectoral. Dorsal fin low, but distinct; anal much more developed than dorsal; its longest rays about in the middle of the fish. Air bladder long, slightly constricted behind. Gill-membranes not covering isthmus. Head 7½; depth of head 15. (*Putnam.*) Florida Keys to Cuba and Panama.

(*Carapus ? affinis* Poey, Syn. Pisc. Cub. 1868, 402, not of *F. affinis* Günther; Putnam, Proc. Bost. Soc. Nat. Hist. 1874, 344.)

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* In the Museum of Comparative Zoölogy is "one valve of a pearl oyster, in which a specimen of *Fierasfer dubius* is beautifully inclosed in a pearly covering, deposited on it by the oyster." (*Putnam.*)

Family CXVIII.—OPHIDIIDÆ.

(*The Ophidioids.*)

Body elongate, compressed, more or less eel-shaped, naked or covered with very small scales, which are not imbricated, but placed in oblique series at right angles with each other; head large; lower jaw included; both jaws, and usually vomer and palatines also, with villiform or cardiform teeth; premaxillaries protractile; gill-openings very wide, the gill-membranes separate, anteriorly narrowly joined to the isthmus behind the ventrals; pseudobranchiæ small or obsolete. Gills 4, a slit behind the fourth; vent more or less posterior. Vertical fins low, without spines, confluent around the tail; tail isocercal; ventral fins at the throat, each developed as a long, forked barbel. Air-bladder and pyloric cœca present. Genera 3, species about 12. Carnivorous fishes, found in most warm seas.

(*Ophidiidæ*, group *Ophidiina* Günther, iv, 376–380.)

a. Body scaly.
b. Palatines with a band of villiform teeth only ..... Ophidium, 433.

433.—OPHIDIUM Linnæus.

(*Ophidion* Artedi; Linnæus Syst. Nat.: type *Ophidion barbatum* L.)

Body moderately elongate, compressed; scales small, not imbricated, but arranged in short oblique series, placed at right angles with each other, much as in *Anguilla*. Head naked, or somewhat scaly; teeth villiform, those of the outer series more or less enlarged; teeth on vomer and palatines bluntish, some of them enlarged. Vent well behind pectorals. (*Ophidium*, an ancient name, from ὀφίδιον, a small snake.)

a. Outer teeth of jaws fixed. (*Ophidium.*)

1219. O. marginatum Dek.

Color nearly plain brownish; dorsal and anal fins margined with black. Maxillary reaching posterior margin of orbit; air-bladder short and broad, with a foramen on the under side; outer ray of ventrals about equalling length of head; inner ray half length of outer. Gill-rakers 4. Head $6\frac{1}{2}$; depth $7\frac{1}{2}$. Atlantic coast of North America from New York southward.

(Dekay, N. Y. Fauna, Fish. 1842, 315; Putnam, Bost. Soc. Nat. Hist. 1874, 342.)

1220. O. josephi Grd.

Pale olive, sprinkled all over with brownish specks; belly and sides of head plain; vertical fins edged with black. Eye moderate, 4 in head; maxillary extending to opposite its posterior margin; origin of dorsal at some distance behind base of pectorals. Body shorter and pectorals more elongate than in *O. taylori*. Head 6. Saint Joseph's Island, Texas. (*Girard.*)

(*Ophidion josephi* Girard, U. S. Mex. Bound. Surv. Ichth. 1859, 29.)

1221. O. holbrooki Putnam.

"Inner barbel nearly two-thirds length of the outer; outer barbel equal to the distance from the center of the eye to the point of the operculum; maxillary reaching to the posterior border of the eye. Length of the eye equal to the distance from its posterior margin to the ridge of the preoperculum. Head one-sixth of the total length of the fish. Dorsal and anal with a black margin. Gill-rakers 4. Air-bladder long, pointed, without a foramen." L. 6 inches. Key West, Florida. (*Putnam.*)

(Putnam, Proc. Bost. Soc. Nat. Hist. 1874, 342.)

1222. O. taylori Girard.

Light olive; head and upper parts covered with conspicuous round dark, olive-brown spots; chin dusky; vertical fins edged with black. Head large, little compressed, naked; top of head with conspicuous mucous pores. Dorsal fin beginning over the pectorals; outer ray of ventrals little more than half length of head; inner about one-third. Air-bladder ovate, not contracted; seven gill-rakers below the angle of the arch; pseudobranchiæ developed. No spine on the end of the snout. Outer teeth in both jaws considerably enlarged, the upper largest. Head 6; depth 8. L. 12 inches. Coast of California; not rare.

(Girard, U. S. Pac. R. R. Surv. Fish. 1859, 138.)

aa. Outer teeth in jaws movable; head scaly above. (*Leptophidium** Gill.)

1223. O. profundorum (Gill) J. & G.

Light rufous; vertical fins margined with black. Body very slender; scales regularly arranged in quincunx order; scales on head extending to forehead, opercles, and cheeks; snout high, projecting, armed with a concealed spinous hook; teeth villiform, separated by an interval from an outer row of longer, slender, movable teeth; eye longer than snout, $3\frac{1}{2}$ in head; lateral line obsolete behind; vent toward end of first third

*Gill, Proc. Acad. Nat. Sci. Phila. 1863, 210: type *Leptophidium profundorum* Gill. (λεπτός, slender; ὀφιδιον, Ophidium.)

of length; ventral fins short. Head 6; depth 10. Gulf Stream, off the coast of Florida. (*Gill.*)

(*Leptophidium profundorum* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 211.)

Family CXX.—GADIDÆ.*

(*The Cod-fishes.*)

Body elongate, more or less compressed behind; tail usually isocercal (diphycercal in *Dinematichthys*); scales cycloid, small, sometimes wanting. Gill-openings very wide; gill-membranes separated or somewhat united, commonly free from the isthmus; no spines, the fin-rays all articulated. Dorsal fin extending almost the length of the back, forming one, two, or three fins; anal fin long, single or divided; caudal fin distinct, or confluent with the dorsal and anal; ventral fins jugular, but attached to the pubic bone, each of one to eight branched rays. Gills 4, a slit behind the fourth. No pseudobranchiæ. Edge of preopercle usually covered by skin of head. Pyloric cœca usually numerous, but sometimes few or none. Air-bladder generally well developed. Genera 35, species about 90; an important family, many of its members being highly valued as food. They inhabit chiefly the northern seas; one genus (*Lota*) being confined to the fresh waters. Two genera (*Stygicola*, *Lucifuga*) are blind and inhabit the cave streams of Cuba.

(*Gadidæ* Günther, iv, 326–369; *Ophidiidæ*, group *Brotulina*, iv, 371–376.)

a. Body scaly.
  b. Vertical fins united or approximated; pyloric cœca two; no barbel. (*Brotulinæ.*)
    c. Vertical fins united ..... Bythites, 434.
    cc. Vertical fins separate; tail diphycercal ..... Dinematichthys, 435.
  bb. Vertical fins well separated; pyloric cœca mostly numerous; tail isocercal.
    d. Frontal bone single, normal. (*Gadinæ.*)
      e. Anterior dorsal composed of a band of fringes preceded by a slender ray; barbels 3 to 5.
        f. Ventral rays 3 to 5; anal fin entire ..... Onos, 436.
      ee. Anterior dorsal composed of distinct rays.
        g. Chin with a barbel.
          h. Dorsal fins two; anal fin one.
            i. Ventral fins narrow, filamentous, each composed of two or three slender rays ..... Phycis, 437.
            ii. Ventrals broader, each of about six rays.
              j. Tail attenuate; anal fin notched; mouth inferior; deep-sea fishes. Haloporphyrus, 438.
              jj. Tail normal; anal fin entire; mouth terminal.
                k. Vomer toothless; teeth villiform ..... Physiculus, 439.
                kk. Vomer with teeth.
                  l. Vomer and mandible with canines ..... Molva, 440.
                  ll. Vomer and mandible without canines ..... Lota, 441.

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*Including family 119, *Brotulidæ*, in the key to the families, page 79.

hh. Dorsal fin single; anal fin single; ventrals well developed. BROSMIUS, 442.

hhh. Dorsal fins three; anal fins two..... GADUS, 443.

gg. Chin without barbel; lower jaw projecting; scales large; dorsals two; anal one ..... HYPSICOMETES, 444.

dd. Frontal bone divided; top of head with a triangular excavated area; no barbel. (*Merluciinæ.*)

p. Lower jaw projecting; dorsals two; anal one; anal and second dorsal deeply emarginate..... MERLUCIUS, 445.

aa. Body naked; mouth very large; abdomen greatly dilatable; teeth very unequal; jaws with very long, depressible canines. (*Chiasmodontinæ*)..... CHIASMODON, 446.

434.—BYTHITES Reinhardt.

(Reinhardt, Dansk Vidensk. Selsk. Afhandl. vii, 178, 1838; type *Bythites fuscus* Reinh.)

Body elongate, covered with minute scales. Head large, thick; mouth large; jaws equal; no barbel; bands of teeth in the jaws and on vomer and palatines. Branchiostegals eight; gill-membranes united, free from the isthmus; eye moderate. Lateral line interrupted. Vertical fins united; ventral fins reduced to simple filaments, each composed of two rays closely united. Air-bladder large; two pyloric cœca. A thick, conical, anal papilla (in the male). Greenland. (βυθίτης, an animal of the depths, from βύθιος, the deep.)

1224. B. fuscus Reinh.

Uniform dark-brown. Head with minute cirri; snout obtuse; maxillary extending to below eye; vertical fins enveloped in thick skin; ventrals two-thirds as long as head. Depth less than length of head. Greenland. (*Günther.*)

(Reinhardt, l. c. 179; Günther iv, 375.)

435.—DINEMATICHTHYS Bleeker.

(*Brosmophycis* Gill: *Halias* Ayres.)

(Bleeker, Batoë, 318; type *Dinematichthys ilyocœteoides* Bleeker.)

Body moderately elongate, covered with minute imbedded scales; lateral line inconspicuous; head moderate, conical; opercle with a spine posteriorly; preopercle unarmed, usually with a large mucous pore at its angle; no barbels; jaws subequal; teeth in the jaws cardiform, in bands anteriorly; vomer and palatines with similar teeth; gill-membranes little connected. Dorsal fin low, continuous, its last rays contiguous to the caudal, but nearly or quite free from it; anal fin even, similar to dorsal, but shorter; rays of vertical fins slender, much branched; ventrals reduced each to a filament formed of two rays

closely joined; caudal short and slender; tail diphycercal, truncate at base of caudal; anal papilla large (in ♂); stomach large, with two short pyloric cœca. (δις, two; νῆμα, thread; ἰχθὺς, fish.)

a. Head nearly or quite scaleless. (*Halias** Ayres.)

1225. D. marginatus (Ayres) Gthr.

Reddish brown; fins broadly edged with bright rose red. Head with traces of very rudimentary scales sunken in the skin; eye well forward, 1½ in snout, 7 or 8 in head; maxillary reaching beyond eye a little less than half length of head; teeth of jaws subequal, in broad bands; palatine teeth in a short band, shorter than eye. Fin-rays slender, imbedded in skin; pectorals moderate, a little more than half length of head; ventrals half length of head; nape nearer origin of dorsal than tip of snout; vent slightly behind middle of body; caudal as long as eye and snout; a conspicuous pore above tip of maxillary; two pores at chin; anal papilla without horny appendages; lower lip with a fringe of minute cirri. Head 4½ in length; depth about 6. D. about 80; A. about 65. Coast of California, rather rare; in deep water.

(*Brosmius marginatus* Ayres, Proc. Cal. Acad. Nat. Sci. i, 13, 1854: *Halias marginatus* Ayres, Proc. Cal. Acad. Nat. Sci. 1860, 52; Günther, iv, 375: *Brosmophycis marginatus* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 168; 1863, 253.)

436.—ONOS† Ayres.

Rocklings.

(*Motella* Cuvier: *Molvella* Kaup: *Rhinonemus* Gill: *Ciliata* Couch and *Couchia* Thompson, young forms.)

(Risso, Hist. Nat. d'Eur. Merid. iii, 214, 1826: type *Onos mustella* Risso = *Gadus tricirratus* Bl. & Schn.)

Body rather elongate, covered with very small scales; head more or less depressed; lower jaw included; chin with a barbel; snout with two to four barbels, one on each anterior nostril; teeth in bands on jaws and vomer; none on palatines; some of the teeth in upper jaw sometimes enlarged or canine-like; dorsal fins two, the anterior composed of small fringe-like rays concealed in a groove, in front of these a single long ray; second dorsal long; anal similar; caudal fin rounded or lanceo-

*Ayres, Proc. Cal. Acad. Nat. Sci. ii, 52, 1860: type *Brosmius marginatus* Ayres. (ἅλς, the sea.)

†We do not adopt the earlier name *Gaidropsarus* of Rafinesque, because we find little evidence that the rough figure of Rondelet, on which *Gaidropsarus mustellaris* Rafinesque was founded, was intended for a species of *Onos* rather than of *Phycis*. *Enchelyopus* Bloch & Schneider is a heterogeneous group, including species of *Gadus*, of which genus it may be considered a synonym.

late; tail isocercal; ventral fins of 5 to 7 rays. Small fishes of the northern seas; the species differing considerably among themselves. (*Onos*, an ancient name of certain Gadoid fishes; from ὄνος, an ass.)

a. Barbels four; head anteriorly high and compressed; no large canines. (*Rhinonemus* Gill.)

1226. O. cimbrius (L.) Goode & Bean.—*Four-bearded Rockling.*

Brownish, posterior part of dorsal and anal, and lower margin of caudal abruptly black; inside of mouth black. Head oblong, compressed, the snout high, its anterior profile blunt; mouth large, inferior; a barbel at chin, one at end of snout, and one on each anterior nostril; maxillary reaching much beyond eye; teeth in narrow bands, some of them considerably enlarged; lateral line stitch-like, developed at intervals. First (free) ray of dorsal as long as head; ventrals about half length of head; caudal somewhat acute. Head 5; depth 6. D. 50; A. 43; V. 5. L. 12 inches. North Atlantic, on both coasts.

(*Gadus cimbrius* Linnæus, Syst. Nat.: *Motella caudacuta* Storer, Hist. Fish. Mass. 361: *Motella cimbria* Günther, iv, 367: *Rhinonemus caudacuta* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 241.)

aa. Barbels three. (*Onos.*)

1227. O. reinhardti (Kröyer) Gill.

Uniform reddish brown; cirri and tips of fins red. Head depressed, but rather pointed anteriorly; snout rather short, with two barbels; chin with one; teeth in villiform bands, those of one series in each jaw longer than the rest. First ray of first dorsal short, little longer than snout. Vent near middle of length. Distance from snout to first dorsal $\frac{3}{10}$ of length. Head 5. D. 56; A. 45; V. 8. Greenland. (*Collett.*)

(?*Motella argentata* Reinh. Selsk. Nat. Math. Afh. 1837, 110: *Motella reinhardti* Kröyer MSS.; Collett, Norske Nord-Havs. Exp. 1880, 131: *Onos reinhardti* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 241: ?*Couchia argentata* Günther, iv, 363, the young of this or other species of *Onos;* small, silvery fishes, swimming at the surface in the open sea.)

1228. O. ensis (Reinh.) Gill.

Head small; snout with two barbels; chin with one; teeth feeble, uniform, in villiform bands; palatine teeth villiform. Vent nearly median; distance to front of dorsal $\frac{3}{8}$ of length. First dorsal ray produced, as long as head. Head $5\frac{3}{4}$; D. 59; A. 46. Greenland. (*Collett.*)

(*Motella ensis* Reinh. Dansk. Vidensk. Selsk. Nat. vii, 115, 1838: *Onos ensis* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 241; Collett, l. c. 134.)

437.—PHYCIS* Bloch & Schneider.

Codlings.

(Bloch. & Schneider, Syst. Ichth. 1801, 56: type *Phycis tinca* Bloch & Schneider.)

Body rather elongate; head subconic; mouth rather large, the maxillary reaching to below eye; lower jaw included; chin with a small barbel; jaws and vomer with broad bands of subequal, pointed teeth; palatines toothless. Dorsal fins two, the first sometimes produced at tip; second dorsal long, similar to the anal. Ventrals wide apart, filamentous, each of 2 or 3 slender rays. Gill-membranes somewhat connected, narrowly joined to the isthmus. (φῦκίς, an ancient name of some fish living in the Fucus, φῦκος.)

a. Dorsal rays scarcely produced. (*Urophycis*† Gill.)

1229. P. regius (Walb.) J. & G.

Pale brownish tinged with yellowish, the lateral line dark brown, interrupted by white spots; inside of mouth white; first dorsal largely black, this color surrounded by white; second dorsal olivaceous, with irregular round dark spots; caudal, anal, and pectorals dusky; ventrals and lower edge of pectorals white; two vertical series of round dark spots on the sides of the head. Body rather stout; head broad; mouth large, the maxillary reaching posterior margin of eye. Eye less than snout or interorbital width; first dorsal low, its height about equal to half length of head; ventral fin longer than head, about 3½ in length of body; caudal fin subtruncate. Head 4¼; depth 4½. D. 8–43; A. about 45; scales rather large, about 90 in the lateral line. North Atlantic, south to Cape Fear. Said to exhibit electric powers in life.

(*Blennius regius* Walb. Art. Pisc. 1792, 186: *Phycis punctatus* Dek. N. Y. Fauna, Fish. 292: *Enchelyopus regalis* Bloch. & Schn. 1801, 53: *Phycis regalis* Günther, iv, 355.)

1230. P. earlli Bean.

Brown, with some light spots on the second dorsal fin and on the sides; anal and both dorsals margined with brown. Body short and stout; maxillary extending beyond front of eye; barbel one-third length of upper jaw, which is half length of head; interorbital space equal to length of snout; pectorals as long as postorbital part of head;

""*Hypsiptera argentea*" Günther (ii, 386; iv, 362); a very small silvery fish, occasionally taken on our coasts as well as on those of Europe, is now supposed to be the young of species of *Phycis*.

†Gill, Proc. Acad. Nat. Sci. Phila. 1863, 240: type *Gadus regius* Walb. (*ουρά*, tail; φῦκίς, Phycis.)

ventrals reaching nearly to vent; none of the rays of first dorsal produced, the fin not higher than second dorsal. Head $3\frac{2}{3}$; depth $4\frac{1}{2}$. D. 10-62; A. 53; P. 15; Lat. l. 155. L. 14 inches. Charleston, South Carolina.

(Bean, Proc. U. S. Nat. Mus. iii, 69, 1880.)

aa. One of the rays of the first dorsal more or less produced. (*Phycis.*)

1231. P. chuss (Walb.) Gill.—*Codling; Squirrel-hake.*

Brownish above, sides lighter and tinged with yellowish; thickly punctulate with darker; below pale; inside of mouth white; vertical fins somewhat dusky; anal fin margined with pale; lateral line not dark. Body rather slender; head depressed; eye large, about equal to interorbital width; maxillary reaching posterior margin of pupil. Filamentous dorsal ray about two-sevenths length of body, when perfect; pectorals $\frac{4}{5}$ length of head; ventral fins extending beyond the vent; scales comparatively large. Head $4\frac{1}{2}$; depth 5. D. 9–57; A. 50; Lat. l. 110. Atlantic coast, chiefly northward.

(*Blennius chuss* Walb. Art. Pisc. 1792, 186: *Enchelyopus americanus* Bl. & Schn. 1801, 53: *Phycis americanus* Günther, iv, 353: *Phycis filamentosus* Storer, Fish. Mass. 367; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 237.)

1232. P. tenuis (Mitch.) Dek.—*Codling; White hake; Squirrel-hake.*

Brownish, lighter and yellowish below; fins very dark. Snout longer than eye, narrower and more pointed than in *P. chuss*. Eye large, usually wider than interorbital space; maxillary reaching beyond pupil. Filamentous dorsal ray about two-thirds length of head; ventral fins about reaching vent. Scales very small. Head $4\frac{1}{4}$; depth $5\frac{1}{2}$. D. 9–57; A. 48; Lat. l. 138. Distinguished from the preceding chiefly by the smaller scales. North Atlantic, south to Virginia; abundant northward.

(*Gadus tenuis* Mitch. Trans. Lit. & Phil. Soc. N. Y. 1815, 372; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 238: *Phycis dekayi* Kaup, Archiv. Naturg. i, 89, 1858.)

1233. P. chesteri Goode and Bean.

Eye $3\frac{1}{3}$ in length of head; maxillary twice in head; barbel one third diameter of orbit; vent equidistant from tip of snout and end of second dorsal; distance from snout to dorsal fin equals twice the length of the mandible; the third ray of the second dorsal extremely elongate, its length more than twice that of head, and more than four times that of the longest of the other rays; ventral fins with the first ray one-third length of body, the second about three times the length of the head,

the third shorter than the diameter of orbit; pectorals four times as long as the opercle. Scales large and thin; lateral line much broken posteriorly. Head $4\frac{1}{4}$; depth 5. D. 9 or 10, 56; A. 56; Lat. l. 90. (*Goode and Bean.*) Coast of Massachusetts, in deep water.

(Goode and Bean, Proc. U. S. Nat. Mus. i, 1878, 256.)

438.—HALOPORPHYRUS Günther.

(*Lepidion* Swainson; preoccupied as *Lepidia*.)

(Günther, Cat. Fish. Brit. Mus. iv, 358, 1862: type *Gadus lepidion* Risso.)

Body elongate, compressed, tapering into a slender tail. Scales very small. Head entirely scaly, even to the gill-membranes. Snout depressed, thin and flat, projecting beyond the mouth; mouth rather large; chin with a barbel; jaws with bands of villiform teeth; a small roundish patch of teeth on vomer, none on palatines. Dorsal fins two; the first short, its anterior ray produced into a long filament; anal fin deeply notched, almost separated into two fins; ventral fins with six rays, one of them filamentous; caudal truncate. Branchiostegals 7. Deep-water fishes. (ἁλς, sea; πορφυρος, purple, from the deep coloration.)

1233. H. viola Goode & Bean.

Color, deep violet or blue-black; inside of mouth and opercles blue-black; snout broad, pointed at tip, much depressed, forming a roof-like projection above mouth; a conspicuous keel extending backward from tip of snout along the suborbital to the posterior margin of the eye. Mouth U-shaped, wholly inferior; maxillary nearly reaching posterior margin of orbit; interorbital space flat, as wide as the large eye, the orbital ridges somewhat elevated; barbel about one-half diameter of orbit. First dorsal with its first ray much produced, longer than head; anal fin deeply notched near its middle. Caudal peduncle as long as eye; its depth more than half its length; longest ray of ventrals reaching about half way to vent; pectoral $1\frac{1}{2}$ in head. Head $4\frac{1}{4}$; depth 5. D. 4–53; A. 40; V. 6; Lat. l. 115. Banks of Newfoundland and southward, in deep water..

(*Haloporphyrus viola* Goode and Bean, Proc. U. S. Nat. Mus. i, 256, 1878.)

439.—PHYSICULUS Kaup.

(Kaup, Wiegmann's Archiv. 1858, 88: type *Physiculus dalwigkii* Kaup.)

Body elongate, covered with small scales; head entirely scaly; snout broad, obtusely rounded, projecting beyond the mouth; mouth of mod-

erate size; chin with a barbel; jaws with bands of villiform teeth; vomer and palatines toothless. Dorsals 2; anal fin single, not notched; ventral fins with 5 rays, the outer rays filamentous; caudal rounded, slender, free; branchiostegals 7. (A diminutive of *Phycis*.)

1234. P. dalwigkii Kaup.

Color uniform brownish; pectoral and anal whitish; axil of pectoral, chin, and belly blackish; inside of mouth white. Head broad, depressed; cleft of mouth oblique; maxillary extending beyond vertical from pupil; interorbital space flat, its width rather less than vertical diameter of orbit; a concealed spine on each side of nape. Height of first dorsal equalling half length of head; second dorsal somewhat lower, nearly uniform in height; anal similar to second dorsal, but lower; pectorals, two-thirds length of head; filamentous ventral ray not reaching anal. Eleven series of scales betweeen anterior dorsal and lateral line. Head 4 in length; depth 5½. D. 7–67; A. 69; V. 5. (*Günther*.) Madeira; lately taken in deep water off the coast of Massachusetts.

(Kaup, Wiegm. Arch. 1858, 88; Günther, iv, 348.)

440.—MOLVA Nilsson.

Lings.

(Nilsson, Skandinav. Fauna, 1832, iv, 573: type *Gadus molva* L.)

Body elongate, covered with very small scales. Chin with a barbel; lower jaw included; bands of teeth on jaws and vomer; lower jaw with large canines which are arrow-shaped and movable; vomer with a curved series of canines, mixed with small teeth, these mostly fixed; no teeth on palatines. Gill-membranes broadly united. Two dorsal fins, both well developed; one anal fin; ventrals of several rays. Northern seas. (An old name of *M. vulgaris*.)

1235. M. vulgaris Fleming.—*Ling*.

Barbel longer than eye; a short barbel at the nostril; eye as wide as interorbital space. D. 15–66; A. 62; V. 6; vertebræ 27 + 37. (*Günther*.) Greenland and Northern Europe.

(*Gadus molva* L. Syst. Nat.; Fleming, Brit. Anim. 192; Günther, iv, 361.)

441.—LOTA Cuvier.

Burbots.

(Cuvier, Règne Anim. ii, 1817: type *Gadus lota* L. = *Lota vulgaris* Jenyns.)

Body long and low, compressed behind. Head small, depressed,

rather broad; anterior nostrils each with a small barbel; chin with a long barbel; snout and lower parts of head naked; mouth moderate, the lower jaw included; both jaws with broad bands of equal, villiform teeth, vomer with a broad, crescent-shaped band of similar teeth; no teeth on palatines. Gill-openings wide, the membrane somewhat connected, free from the isthmus. Scales very small, imbedded; vertical fins scaly. Dorsal fins two, the first short, the second long, similar to the anal; caudal rounded, its outer rays procurrent; ventrals of several rays. One species, living in fresh waters of northern regions. (*Lota*, the ancient name.)

1236. L. maculosa (Le S.) C. & V.—*Burbot; Lake Lawyer; Ling.*

Dark olive, thickly marbled and reticulated with blackish; yellowish or dusky beneath; young often sharply marked, the adult becoming dull-grayish; vertical fins with dusky margins. Maxillary reaching to posterior margin of eye; barbel longer than the very small eye; pectoral $1\frac{3}{5}$ in head; ventrals reaching half way to vent. Head $4\frac{2}{3}$; depth 6. D. 13–76; A. 68; V. 7; vertebræ 21 + 38; cœca 30. L. 2 feet. New England and Great Lake region, north to the Arctic seas; abundant northward; also (var. *vulgaris*) throughout Northern Europe and Asia.

(*Gadus lota* L. Syst. Nat.: *Gadus maculosus* Le Sueur, Journ. Acad. Nat. Sci. Phila. i, 83, 1873: *Lota compressa, inornata,* and *maculosa* Dekay, New York Fauna, Fish. 1842, 283–285: *Lota vulgaris* Jenyns, Manual Brit. Vert. 448: *Lota vulgaris* Günther, iv, 359.)

442.—BROSMIUS Cuvier.

Cusks.

(Cuvier, Règne Anim. ii, 1817: type *Gadus brosme* Müller.)

Body moderately elongate, covered with very small scales. Mouth rather large, with teeth in the jaws, vomer, and palatines, some of those on the vomer and palatines enlarged; chin with a barbel; branchiostegals 7. Dorsal fin single, continuous, not elevated; anal fin similar, but shorter; caudal fin rounded; ventral fins several-rayed. Fishes of the Northern seas. (A latinization of the vernacular name *brosme*.)

1237. B. brosme (Müller) White.—*Cusk.*

Brownish, mottled; young uniform dark slate-color, or with transverse yellow bands; vertical fins bordered with blackish, and with a white edge. Head flattened above; upper jaw slightly longer than lower; mouth large, oblique; maxillary reaching beyond orbit. Head

4¼; depth 5¼. D. 98; A. 71. (*Storer.*) Polar regions, south to Cape Cod and Denmark.

(*Gadus brosme* Müller, Prodr. Zoöl. Dan. 41, 1776: *Gadus brosme* Fabr. Faun. Grœnl. 140; *Brosmius flavescens* Günther, iv, 369: *Brosmius flavescens* Storer, Fish. Mass. 368: *Brosmius brosme* Günther, iv, 369: *Brosmius vulgaris* Dekay, New York Fauna, Fish. 289.)

443.—GADUS Linnæus.

Cod-fishes.

(Artedi; Linnæus, Syst. Nat.: type *Gadus callarias* or *morrhua* L.)

Body moderately elongate, compressed and tapering behind. Scales very small; lateral line present. Head narrowed anteriorly; mouth moderate or large; chin with a barbel, which is sometimes minute; teeth cardiform, subequal, or with those of one series more or less enlarged; vomer with teeth; none on the palatines. Dorsal fins three, well separated; anal fins two; ventral fins well developed, of about seven rays. Species of the Northern Seas; highly valued as food.

(*Gadus*, the Latin name, akin to the English word Cod.)

a. Lower jaw included; barbel well developed.
  b. Vent below second dorsal; species of large size.
    c. Lateral line black; mouth small, the maxillary not reaching eye. (*Melanogrammus** Gill.)

1238. G. æglifinus L.—*Haddock.*

Dark gray above, whitish below; lateral line black; a large dark blotch above the pectorals; dorsals and caudal dusky. Snout long and narrow, overlapping the small mouth; maxillary barely reaching front of orbit; teeth subequal, large, in a cardiform band in upper jaw; in a single series on lower jaw and on vomer; occiput carinated; a ridge extending backward from each orbit; eye very large, two-thirds length of snout, 4 in head. Anterior rays of first dorsal elevated, three-fourths length of head, the fin pointed, higher than second and third dorsals; caudal lunate; vent below front of second dorsal. The skull in this species is more depressed than in *Gadus callarias*, broader, and thinner in texture; occipital crest exceedingly high, much higher than in *Gadus*, the wing-like projections at its base anteriorly spreading widely, raised above the surface of the skull. Head 3¾; depth 4½. D. 15–24–21; A. 23–21. North Atlantic, on both coasts; an important food-fish, reaching a considerable size.

(*Gadus æglifinus* Linnæus, Syst. Nat.: *Gadus æglifinus* Günther, iv, 332: *Melanogrammus æglifinus* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 237.)

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* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 237: type *Gadus æglifinus* L. (μέλας, black; γραμμή, line.)

cc. Lateral line pale; mouth rather large, the maxillary reaching past front of eye.
d. Vertebræ normal. (*Gadus.*)

1239. G. callarias L.—*Common Cod-fish.*

Greenish or brownish, subject to many variations, sometimes yellowish or reddish; back and sides with numerous rounded brownish spots; lateral line pale; fins dark. Head large, but varying much in size; maxillary about reaching middle of orbit; occipital keel not greatly developed; teeth strong, cardiform, in narrow bands, those of the outer row in the upper jaw, and of the inner row in the lower jaw, somewhat enlarged. Eye moderate, about half length of snout. First dorsal little elevated, its height about half length of head; vent under front of second dorsal; caudal slightly emarginate; pectorals half length of head. Head $3\frac{1}{2}$ to $4\frac{1}{2}$; depth about 4. D. 14–21–19; A. 20–18. Northern Seas, south to Virginia, Oregon, and Japan, one of the most important of all food-fishes. The fish of the Pacific Ocean (var. *macrocephalus*) is said to have the air-bladder ("sounds") smaller; it is wholly similar externally. The Greenland form (var. *ogac*) is very dark, with slender caudal peduncle, longer barbel, larger eye, broader interorbital space, longer pectorals, and more advanced ventrals. Great variations occur in size of head and in color among individuals from different regions.

(*Gadus callarias* et *morrhua* Linn. Syst. Nat.; Günther, iv, 328: *Morrhua americana* Storer, Hist. Fish. Mass. 343: *Gadus macrocephalus* Tiles. Mem. Acad. Sci. St. Petersb. ii, 360, 1810: *Gadus macrocephalus* Günther, iv, 330: *Gadus ogak* Richardson, F. B. A. Fish. 246: *Gadus ogac* Bean, Bull. U. S. Nat. Mus. xv, 110: *Gadus auratus* Cope, Proc. Am. Philos. Soc. Phila. 1873.)

dd. Vertebræ peculiarly modified, somewhat as in *Merlucius.* (*Tilesia** Swainson.)

1240. G. gracilis Tiles.

Dusky bluish above, yellowish white below, without spots. Form of a haddock, the body subterete, compressed, the belly prominent. Head oblong, the snout rounded and depressed; upper jaw longer and broader than lower; barbel moderate; outer teeth setaceous; eye large. Scales very small, little imbricated. First dorsal subtriangular; second dorsal lower; third obtusely triangular; pectorals large; ventrals with the second ray produced; caudal equal. Head $4\frac{1}{6}$; depth $4\frac{1}{6}$. D. 14–17–19; A. 21–20; P. 19; V. 6; B. 6. (*Pallas.*) Alaska to Japan. An insufficiently-described species, which, according to Dr. Bean, who has lately obtained it in Bering's Sea, is very distinct from the other members of the genus. It differs from *Gadus callarias* in the structure of its ver-

*Swainson, Nat. Hist. Fish. etc. 1839, 300: type *Gadus gracilis* Tiles. (Dedicated to William Theophilus Tilesius.)

tebræ, resembling the structure found in *Merlucius*. This difference, in Dr. Bean's opinion, may necessitate the revival of the genus *Tilesia* of Swainson.

(*Gadus gracilis* Tilesius, Mem. Acad. Imp. St. Petersb. ii, 354, 1810: *Gadus wachna* Pallas, Zoogr. Ross.-Asiat. iii, 182, 1811: *Tilesia gracilis* Swainson, l. c.: *Tilesia gracilis* Bean, Proc. U. S. Nat. Mus. 1881, 243).

bb. Vent in front of second dorsal; species of small size. (*Microgadus** Gill.)

1241. G. proximus Grd.—*Tom-cod.*

Olivaceous above, pale, or slightly translucent, white below; dorsal fins dusky, paler at base; first anal, and ventrals uncolored; second anal dusted with dark points. Head long, convex above, somewhat compressed, with vertical sides; eye moderate, about 5 in head; mouth rather large; maxillary reaching to below pupil; barbel small; teeth in each jaw in a band, the outer row a little enlarged. Gill-membranes a little connected, free from the isthmus. First dorsal highest, somewhat falcate, its height three-fifths length of head; first anal longer and higher than second; pectorals moderate, reaching anal; ventrals filamentous, scarcely reaching anal; caudal slightly emarginate. Lateral line very distinct, wavy, high anteriorly, slightly interrupted posteriorly. Vent below first dorsal. Head 4; depth $4\frac{2}{3}$. D. 14–18–19; A. 21–21; V. 6 or 7. L. 1 foot. Monterey to Alaska; abundant; a food-fish of some importance.

The Tom-cods (*Microgadus*) differ considerably from the true cods (*Gadus*) in the structure of the cranium. The following is Professor Gill's account of the skull of *G. proximus*, the italicised portions indicating the differences from *Gadus callarias:*

"The cranium is proportionally broader towards the front and less flattened, while the brain-case is flattened below, *decidedly swollen* on each side of a depressed *sphenoidal groove*, and has an ovate cardiform shape; the *paraoccipital* or epiotic is not produced into an angle behind, but is obtusely rounded, and its posterior or *outwardly-descending ridge blunt;* the opisthotic is well developed, oblong, and with its re-entering angle *high up*, and, on a line with it, the surface is divided into two parts—a *narrow* and flattened one, and a lower expanded one, much swollen; the alisphenoid or pro-otic is *oblong*, acutely emarginate in front, swollen from the region of the high anterior sinus, and above a little produced forwards; the great *frontal* is a little longer

*Gill, Proc. Acad. Nat. Sci. Phila. 1865, 69: type *Gadus proximus* Grd. (μικρός, small; γαδος, Gadus.)

than broad, with supraoccipital crest *continued forwards* on the bone, and near the front expanded upwards, and with the *expanded portion* behind dividing into narrow *lateral wings;* the lateral testiform ridges of the frontal are continued forwards and *curved outwards* towards the antero-lateral angles; the anterior frontals are *mostly covered in front* by the great frontal, and are much *developed* in the direction of the antero-lateral angles, the inferior expanded axillary portion being very narrow; the nasal has a rounded ridge in front, continued well below, and its posterior crest is *laminar* and trenchant."

(*Gadus proximus* Grd. Proc. Acad. Nat. Sci. Phila. 1854, 141, and in U. S. Pac. R. R. Surv. 142: *Morrhua californica* Ayres, Proc. Cal. Acad. Nat. Sci. 1854, 9: *Gadus californicus* Günther, iv, 332: *Microgadus proximus* Gill.)

1242. G. tomcod Walb.—*Tom-cod; Frost-fish.*

Olive brown, distinctly blotched and spotted with darker, lighter on the belly; more opaque than in *G. proximus;* back and sides profusely punctulate; dorsals and caudal blotched with darker; anals coarsely punctulate anteriorly, colorless posteriorly; ventrals and pectorals dusky. Snout rounded, less produced than in *G. proximus;* mouth short; maxillary $2\frac{1}{2}$ in head, reaching pupil; eye large, $3\frac{2}{5}$ in head; barbel small; pectorals reaching vent; ventrals filamentous, not reaching vent. Vent under interval between first and second dorsals. Head $3\frac{2}{3}$; depth 5. D. 13–17–18; A. 20–17. L. 11 feet. Virginia to Labrador; common northward.

(*Gadus tom-cod* Walbaum, Artedi, Pisc. 1792, 133: *Morrhua pruinosa* Storer, Fish. Mass. 357: *Gadus tomcodus* Günther, iv, 331: *Microgadus tomcodus* Gill.)

aa. Lower jaw projecting; barbel small, sometimes obsolete.

e. Upper jaw with its teeth subequal. (*Pollachius* Nilss.*)

1243. G. virens L.—*Pollack; Coal-fish; Green Cod.*

Greenish brown above; sides and below somewhat silvery; lateral line pale; fins mostly pale; sometimes a black spot in the axil. Body rather elongate, compressed; snout sharp and conic; mouth rather small, oblique; maxillary reaching beyond front of orbit; lower jaw slightly the longer; teeth in the upper jaw nearly equal, the outer series not being especially enlarged; barbel rudimentary or obsolete. Gill-membranes considerably united, free from isthmus. Vent under first dorsal. Caudal fin lunate. Pectorals short, scarcely reaching

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* Nilsson; Bonaparte, Catologo Metodico, 1846, 45: type *Gadus pollachius* L. (πολλἄῆχ, many-fashioned; an old name, with no obvious application; perhaps merely a latinized form of the common name.)

anal; ventrals short. Head 4; depth $4\frac{1}{4}$. D. 13–22–20; A. 25–20; Lat. l. about 150; vertebræ 54. North Atlantic; common northward on both coasts.

(*Gadus virens* and *G. carbonarius* Linn. Syst. Nat.: *Merlangus purpureus* Storer, Fish. Mass. 358: *Gadus virens* Günther, iv, 339: *Pollachius carbonarius* Gill.)

1244. G. chalcogrammus Pallas.

Blackish above, with silvery luster; everywhere punctulate with black; fins also punctulate; ventrals and first anal pale. Snout conic, sharp, rounded in profile; mouth oblique; maxillary reaching middle of pupil; chin with a minute barbel; teeth small, those of the outer row above slightly enlarged; eye large, wider than the flat interorbital space, 4 in head. Gill-membranes somewhat united, the posterior outline deeply emarginate; vent under interspace between first and second dorsal; first dorsal higher than the others, the second lowest; ventrals filamentous, reaching two-thirds distance to vent; pectorals long, reaching past front of anal; caudal somewhat concave. Head 4; depth 5. D. 12–17–18; A. 18–18; V. 7. North Pacific, south to Monterey.

(*Gadus chalcogrammus* Pallas, Zoogr. Ross.-Asiat. iii, 198, 1811–1831: *Gadus periscopus* Cope, Proc. Amer. Phil. Soc. Phila. 1873: *Gadus chalcogrammus* Günther, iv, 340.)

ce. Upper jaw with an outer series of rather larger teeth. (*Boreogadus** Günther.)

1245. G. saida Lepechin.

Brownish above, silvery below; head, body, and fins minutely dotted with black; the dorsals and pectoral almost entirely black, as is the lower half of the anal fins; lateral line pale. Barbel minute or absent; teeth extremely minute, sharp, those in the outer series a trifle larger; snout longer than eye, which is equal to interorbital space, and about one-fourth head; body elongate; tail slender; caudal deeply forked, the upper lobe the longer; ventrals long, $1\frac{1}{3}$ in head; pectorals $1\frac{1}{2}$; vent below front of second dorsal. Scales very minute, non-imbricate. Head $3\frac{2}{3}$; depth $5\frac{1}{2}$. D. 13–15–21; A. 16–21. (*Collett.*) Greenland to Alaska and Russia.

(*Gadus saida* Lepechin, Nov. Comm. Acad. Scient. Petrop. 1774, 512: *Gadus saida* Günther, iv, 337; Collett, Norske Nord-Havs Exp. 1880, 126: *Merlangus polaris* Sabine, App. Parry's Voyage, ccxi, 1824: *Gadus fabricii* Rich. Fauna Bor.-Amer. iii, 245: *Gadus fabricii* Günther, iv, 336: *Boreogadus polaris* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 233: *Boreogadus saida* Bean, Bull. U. S. Nat. Mus. iv, 108: ? *Gadus pygmæus* Pallas, Zoogr. Ross.-Asiat. iii, 190, 1811: *Gadus agilis* Reinh. Kgl. D. Vid. Selsk. 1838, 126: ? *Gadus glacialis* Peters, Nord-Pol Exp. ii, 172, 1874.)

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*Günther, Cat. Fish. Brit. Mus. iv, 336, 1862: type *Gadus fabricii* Rich. (βορεος, northern; Gadus.)

444.—HYPSICOMETES Goode.

(Goode, Proc. U. S. Nat. Mus. 1880, 347: type *Hypsicometes gobioides* Goode.)

Body elongate, covered with large scales; mouth rather small, horizontal, the lower jaw much projecting; 2 or 3 rows of feeble teeth on jaws and vomer; none on palatines. Eyes large, superior, near together. No barbel; no pseudobranchiæ. Caudal fin separate; 2 dorsal fins, the first of a few long rays, the second with a longer base, entire, and similar to the anal; ventrals well developed, each of 6 rays. Deep-sea fishes. (*Ὑψί*, in deep water; *κωμήτης*, dweller.)

1246. H. gobioides Goode.

Color grayish, clouded with darker; belly pale; a large dark blotch at base of upper rays of caudal. Head rather broad and depressed, its width about equal to greatest depth of body; maxillary reaching front of orbit; snout broad, rounded, as long as eye. Caudal truncate; longest rays of first dorsal as long as the snout; ventrals wide apart, with broad bases, inserted far in advance of the pectorals. Head 3; depth 8. D. 6–17; A. 16; V. 6; Lat. l. 58. L. 2 inches. Gulf Stream, off the coast of Rhode Island. (*Goode.*)

(Goode, Proc. U. S. Nat. Mus. iii, 348, 1880.)

445.—MERLUCIUS Rafinesque.

Hakes.

(Rafinesque, Caratteri di Alcuni Nuovi Generi, etc. 1810, 26: type *Gadus merlucius* L.)

Body elongate, covered with small deciduous scales. Head slender, cónical, the snout long, depressed; a well-defined, oblong, triangular excavation at the forehead, bounded by the ridges on the separated frontal bones; these ridges converge backwards into the low occipital crest; eye rather large; edge of preopercle free; preopercle with a channel behind its crest, crossed by short radiating ridges; mouth large, oblique; maxillaries extending to opposite the eyes; lower jaw longest; no barbels; jaws with slender teeth, of various sizes, in about 2 series, those of the inner row longer and movable; vomer with similar teeth; palatines toothless. Branchiostegals 7. Gill-rakers long; gill-membranes not united. Dorsal fins 2, well separated, the first short, the second long, with a deep emargination; anal emarginate, similar to second dorsal; ventral fins well developed, with about 7 rays; vertebræ peculiarly modified, the neural spines well developed and wedged into one another; frontal bone double and the skull oth-

erwise peculiar in several respects. Species several, very similar. Large, voracious fishes, little valued as food. (*Merlucius*, the ancient name, meaning "Sea-Pike.")

1247. M. bilinearis (Mitch.) Gill.—*Hake.*

Grayish, darker above, dull silvery below; axil and edge of pectoral somewhat blackish; inside of opercle dusky silvery; inside of mouth dusky bluish; peritoneum nearly black. Top of head with the W-shaped ridges very conspicuous; eye shorter than snout, and less than interorbital width; maxillary reaching posterior border of pupil; teeth not very large, smaller than in *M. smiridus*. Scales larger than in other species; pectorals and ventrals long, the latter reaching three-fourths distance to vent, their length about three-fifths that of head. Head $3\frac{3}{4}$; depth $6\frac{1}{2}$. D. 13–41; A. 40; Lat. l. 100–110. Coasts of New England and northward; rather common.

(*Stomodon bilinearis* Mitchill, Rept. Fish. N. Y. 7, 1814: *Gadus albidus* Mitchill, Journ. Acad. Nat. Sci. Phila. i, 409: *Merlucius albidus* Storer, Hist. Fish. Mass. 363; Goode & Bean, Bull. Essex Inst. xi, 9.)

1248. M. smiridus Raf.—*European Hake.*

Dusky above, silvery below; dorsal, caudal, and distal part of pectoral blackish; inside of opercle black; inside of mouth black posteriorly, pale in front; peritoneum black. Ventrals a little more than half head; teeth very long. Head large, $3\frac{1}{3}$; depth $6\frac{1}{2}$. D. 10–36; A. 36; vert. 25 + 26; Lat. l. 150. Coasts of Europe; abundant; straying to Greenland. Here described from specimens taken at Genoa. The identity of the northern species with *M. smiridus* is perhaps uncertain.

(*Gadus merluccius* L. Syst. Nat.; Rafinesque, Caratteri di Alcuni Nuovi Generi, 1810, 26: *Merlucius vulgaris* Fleming, Brit. Anim. 193: *Merlucius vulgaris* Günther, iv, 344: *Epicopus gayi* Günther, ii, 248.)

1249. M. productus (Ayres) Gill.—*Merluccio.*

Silver gray; head dusted with coarse black dots; inside of mouth and opercle jet black; peritoneum silvery, with black specks. Head with the W-shaped ridges less strongly marked; maxillary reaching center of pupil; eye large; pectorals long and narrow, reaching vent; ventrals much smaller than in *M. bilinearis*, reaching half way to vent; their length about $\frac{2}{5}$ that of head; caudal somewhat forked. Scales quite small, deciduous. Teeth moderate. Head $3\frac{3}{4}$; depth 7. D. 11–41; A. 43; V. 7. Lat. l. 136. L. 3 feet. Pacific coast, from Santa Barbara northward; abundant.

(*Merlangus productus* Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 64: *Homalopomus trowbridgii* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 132: *Gadus productus* Günther, iv, 338; Gill, Proc. Acad. Nat. Sci. Phila. 1863, 247.)

446.—CHIASMODON Johnson.

(Johnson, Proc. Zool. Soc. Lond. 1863, 408: type *Chiasmodon niger* Johnson.)

Body elongate, compressed, and tapering posteriorly, naked; belly pendent, its walls membranaceous, capable of great dilation. Mouth very large; lower jaw longer than upper, without barbel; both jaws with two series of large, pointed teeth, some of the anterior being very large and movable; vomerine teeth none; palatines with teeth similar to those in the jaws. Gills 4. No pseudobranchiæ. Gill-openings very wide, the membranes joined to the isthmus for a short distance. Dorsal fins two; anal single; ventrals inserted below pectorals, each of five soft rays. Tail not isocercal, truncate at base of caudal. Caudal forked, free from dorsal and anal. Singular fishes of the deep sea, remarkable for their ability to swallow fishes of many times their own size by means of the great distensibility of the walls of the body. The position of this genus in the family *Gadidæ* is doubtful. (*χιάσμα*, a mark of the form of the letter X; *οδων*, tooth; the two anterior canines crossing each other when depressed.)

1250. C. niger Johnson.

Entirely black. Head compressed, elongate, the crown flat, its depth less than half its length; maxillary reaching angle of preopercle; both jaws armed with long, pointed, wide-set teeth, nearly all of which are movable; two anterior teeth of upper jaw very long, crossing each other when depressed; three anterior pairs of teeth in lower jaw likewise prolonged, the third pair the longest; palatines with a longer, fixed tooth in front. Eye moderate, above the anterior part of maxillary, $4\frac{1}{2}$ in head, shorter than snout, as wide as interorbital space. Lateral line in a longitudinal groove. First dorsal of slender rays, its base $2\frac{1}{3}$ in that of second dorsal; anal commencing behind second dorsal, its anterior rays without connection with vertebral column; posterior rays of anal and dorsal very feeble; pectoral as long as head without snout; ventral half as long as pectoral. Head $3\frac{1}{2}$. D. 11–28; A. 27; P. 13; V. 5. L. 12 inches. (*Günther.*) Deep seas; taken at Madeira and off the coast of Massachusetts.

(Johnson, l. c. 408: *Chiasmodus niger* Günther, v, 435.)

Family CXXI.—MACRURIDÆ.

(*The Grenadiers.*)

Body elongate, tapering into a very long compressed tail, which ends in a point; scales moderate, very rough, usually keeled or spinous.

Teeth villiform or cardiform, in bands, on the jaws only; tip of lower jaw with a barbel; premaxillary protractile. Dorsals two, the first short and high, of stiff, spine-like branched rays; the second dorsal very long, of very low feeble rays, continued to the end of the tail; anal fin similar to the second dorsal, but much higher; no caudal fin; ventrals small, subjugular, each of about 8 rays. Branchiostegals 6 or 7. Lateral line present. Gills 4, a slit behind the fourth. Gill-rakers very small; gill-membranes narrowly united to the isthmus; no pseudobranchiæ; pyloric cœca numerous; air-bladder present. Genera about 5; species about 15, chiefly of the northern seas, in deep water. (*Macruridæ* Günther, iv, 390–398.)

a. Scales of moderate size.
  b. Snout produced, conical; cleft of mouth entirely inferior.....MACRURUS, 447.
  bb. Snout short, obtuse, truncated; cleft of mouth lateral.
    CORYPHÆNOIDES, 448.

447.—MACRURUS Bloch.

(*Lepidoleprus* Risso.)

(*Macrourus* Bloch, Ichth. v, 152, 1787: type *Macrourus rupestris* Bloch, not of Gunner.)

Snout broadly conical, high, projecting beyond mouth; mouth moderate, its cleft horizontal, U-shaped, entirely inferior; teeth of the outer series not enlarged; head sometimes with roughened bony ridges, one of which, on the suborbital and preorbital, simulates the suborbital stay of the Cottoids; eyes very large; scales very rough, keeled, the keels usually ending in spines. Deep water fishes; mostly northern. This genus grades into the next, and is perhaps unworthy of retention. (μακρος, long; οὐρά, tail.)

a. Suborbital region with a conspicuous bony ridge extending from the preopercle along the suborbital and preorbital to the end of the projecting snout.

1251. M. fabricii Sundevall.—*Rat-tail; Grenadier.*

Dusky, inside of mouth and gill-openings black; peritoneum black. Snout sharp, nearly as long as eye, 3½ in head; an area of loose, roughish, naked skin between the suborbital ridge and the mouth; supraocular and occipital ridges present, the interocular space concave. Scales each with a longitudinal serrate ridge ending in a spine; first ray of dorsal denticulated toward the tip; vent behind origin of second dorsal; 5 rows of scales between first dorsal and lateral line. Head 4⅓; depth 6. Eye 3 in head. D. 12–124; A. 148; V. 8; Lat. l. ca. 125. Massachusetts to Greenland and Norway, in deep water; not rare.

(*Coryphæna rupestris* Müller, Zool. Dan. Prodr. 1776, 443 (not of Gunner): *Macrourus rupestris* Bloch, i, 152: *Macrurus rupestris* Günther, iv, 390: *Macrurus fabricii* Sundevall, Vet. Akad. Handl. 1840, 6.)

1252. M. carminatus Goode.

Silver-gray. Body stouter than in *M. bairdi*, the tail less attenuate. Scales heavy, covered with long spines arranged in nine or ten rows, like wool-cards (*carmen*), those of the middle row similar to the others. Eye as deep as width of interorbital space, 5 in head. Snout long, sharp, depressed, triangular, 3 in head, its lateral ridges well developed, running in a straight line under the eyes; a strong horizontal ridge from supraorbital to gill-openings parallel with subocular ridges; barbel very short. Long ray of dorsal unarmed; anal rather high, its longest rays equal to half width of interorbital space; pectoral not reaching anal; ventral behind pectoral, its filament not reaching anal. Head 5; depth 8. D. 10–80+; A. 76+; P. 13; V. 7; scales *ca.* 5–100–12. Gulf Stream, off the coast of Rhode Island. (*Goode.*)

(Goode, Proc. U. S. Nat. Mus. 1880, 346.)

aa. Suborbital region without conspicuous bony ridge.

1253. M. bairdi Goode & Bean.

Brownish gray, bluish below; membrane of first dorsal and under surface of snout pink; throat and branchiostegals deep violet; front of dorsal and anal blackish. Snout sharp, quadrate, shorter than eye, with 4 radiating ridges; bony ridge of preorbital and suborbital obsolete, this region unarmed and soft to the touch; mouth less distinctly inferior than in other species. Scales keeled; first long ray of first dorsal strongly serrate anteriorly; vent under middle of first dorsal. Head 6½; depth 8. D. 12–137; A. 120; scales 6–152–20. Deep water, off the coast of New England. This species approaches *Coryphænoides*, and renders the distinction of the genus *Macrurus* doubtful.

(Goode & Bean, Amer. Journ. Sci. Arts, xiv, 471, 1877.)

448.—CORYPHÆNOIDES Gunner.

(Gunner, Trondhj. Selsk. Skrift. iii, 50, 1765: type *Coryphænoides rupestris* Gunner.)

Snout short, obtuse, high, obliquely truncated, soft to the touch, except its bony center; cleft of the mouth lateral; head without prominent ridges, the membrane bones of the side of the head soft and papery; teeth in the outer series of upper jaw somewhat enlarged. Scales smooth or spinous. Lower jaw with a barbel. (*κορυφαίνα, Coryphæna; εἶδος*, resemblance.)

1254. C. rupestris Gunner.

Bones of front and sides of head thin and papery; no bony ridges on sides of head; angle of preopercle with a conspicuous four-angled

process. Eyes very large, longer than snout, $3\frac{1}{3}$ in head; maxillary extending to below posterior edge of pupil. Pectorals inserted above ventrals and below first ray of dorsal, which is strong, compressed, and armed anteriorly with sharp teeth directed upward; vent under last ray of first dorsal. Scales small, rough, but not keeled. Head 4; depth $5\frac{1}{2}$. First D. 11; A. *ca.* 110; V. 8. Banks of Newfoundland to Norway, in deep water.

(*Coryphænoides rupestris* Gunner, Trondhj. Selsk. Skrift. iii, 50, 1765: *Coryphænoides norvegicus* Günther, iv, 396: *Macrourus norvegicus* Nilsson, Skand. Fauna Fiske 600, 1832: *Macrourus strömi* Reinh. Dansk. Vidensk. Afhandl. vii, 129.)

Order U.—HETEROSOMATA.

(*The Flat-fishes.*)

"Cranium posteriorly normal; anteriorly with twisted vertex, to allow two orbits on the same side, or one vertical and one lateral; basis cranii not quite simple. Dorsal fin long, of jointed rays. Superior pharyngeals 4, the third longest, much extended forward, the inferior separate." (*Cope.*) This order includes the single family of *Pleuronectidæ*. (Ἕτερος, different; σῶμα, body.)

(*Anacanthini pleuronectoidei* Günther, iv, 399–504.)

Family CXXII and CXXIII.—PLEURONECTIDÆ.

(*The Flounders.*)

Body strongly compressed, oval or elliptical in outline; head unsymmetrical, the cranium twisted, both eyes being on the same side of the body, which is horizontal in life, the eyed side being uppermost and colored, the blind side lowermost and usually plain. In very young fishes the bones of the head are symmetrical, one eye on each side, and the body vertical in the water. In some species the cranium becomes twisted, bringing the upper eye over with it; in others the upper eye moves through the cranium. Mouth small or large, the dentition various; premaxillaries protractile; no supplemental maxillary bone; pseudobranchiæ present. Gills 4, a slit behind the fourth; lower pharyngeals separate; no air-bladder; vent not far behind head. Scales various, rarely absent, usually small. Lateral line usually present, extending on the caudal fin, sometimes duplicated or wanting. Dorsal fin long, continuous, of soft rays only, beginning on the head; anal

similar, shorter; caudal various, sometimes coalescent with dorsal and anal; pectorals inserted rather high, sometimes wanting; ventrals under the pectorals, usually of several soft rays, sometimes wanting. Fishes mostly carnivorous, inhabiting sandy bottoms in all seas, some species ascending rivers. Many of them are important food-fishes. Genera about 40; species nearly 400.

(*Pleuronectidæ* Günther, iv, 399–504.)

a. Pectoral and ventral fins both present; caudal distinct; margin of preopercle more or less free.

b. Mouth large; teeth nearly equally developed on both sides of the mouth.

c. Ventral fin of the left side inserted nearly on the ridge of the abdomen; body sinistral.

d. Vomer with teeth; lateral line arched in front; scales small or obsolete. BOTHUS, 449.

dd. Vomer toothless; lateral line not arched; scales well developed, mostly ciliated ..... CITHARICHTHYS, 450.

cc. Ventral fins both lateral; vomer and palatines toothless.

e. Caudal fin lunate.

f. Lateral line arched in front; scales cycloid..... HIPPOGLOSSUS, 451.

ff. Lateral line not arched.

g. Teeth not arrow-shaped; gill-rakers few, short. PLATYSOMATICHTHYS, 452.

gg. Teeth arrow-shaped; gill-rakers numerous, long. ATHERESTHES, 453.

ee. Caudal fin not lunate, the middle rays produced.

h. Lateral line arched in front; body usually sinistral. PARALICHTHYS, 454.

hh. Lateral line not arched; body dextral. HIPPOGLOSSOIDES, 455.

bb. Mouth small; teeth, if present, most developed on the blind side.

j. Teeth small, acute, in several series; lateral line nearly straight, with an accessory branch; scales small, cycloid; eyes dextral.

k. Lips longitudinally plicate; dorsal fin beginning on the blind side..... PLEURONICHTHYS, 456.

kk. Lips simple; dorsal fin beginning on the median line. HYPSOPSETTA, 457.

jj. Teeth in one series.

l. Teeth rather large, bluntish or trenchant; eyes dextral (sometimes sinistral in one species); ventrals (usually) both lateral.

m. Dorsal fin with less than 80 rays; anal with less than 60. PLEURONECTES, 458.

mm. Dorsal fin with more than 95 rays; anal with more than 80; body unusually elongate.

n. Left side of skull with strong mucous cavities; anal spine present..... GLYPTOCEPHALUS, 459.

nn. Left side of skull without conspicuous mucous cavities; anal spine obsolete ..... CYNICOGLOSSUS, 460.

ll. Teeth small, acute, in one series; lateral line nearly straight, simple; scales thin, ctenoid; eyes sinistral; left ventral on ridge of abdomen..... ETROPUS, 461.

jjj. Teeth none; eyes sinistral; caudal fin subsessile; body translucent ..... THYRIS, 462.

aa. Pectoral fins one or both reduced or wanting; margin of preopercle usually not free.

o. Vertical fins free from the caudal.

p. Eyes sinistral; caudal subsessile; left pectoral only present; lateral line present, arched on eyed side, straight on blind side.....MONOLENE, 463.

pp. Eyes dextral; ventral of right side continuous with anal; pectoral fin single small, or wanting; scales very rough; lateral line single, straight; teeth villiform, on blind side only.....ACHIRUS, 464.

oo. Vertical fins confluent around the pointed tail; body sinistral; no pectoral fins; one ventral present; eyes very small.

q. No lateral line; ventral free from anal; teeth minute, on blind side only; snout not hooked; scales ctenoid .....APHORISTIA, 465.

449.—BOTHUS Rafinesque.

Turbots.

(*Rhombus* Cuvier, not of Lacépède: *Lepidorhombus* Gthr.: *Scophthalmus* Raf.: *Lophopsetta* Gill.)

(Rafinesque, Caratteri di Alcuni Nuovi Generi, 1810, 23: type *Bothus rumolo* Raf. = *Pleuronectes rhombus* L.)

Eyes and color on the left side. Body broadly ovate, strongly compressed; mouth large, oblique, the maxillary reaching to beyond eye; teeth subequal, in villiform or cardiform bands, sometimes in single series; a small patch of teeth on the vomer. Scales small, ctenoid or cycloid, sometimes obsolete; skin sometimes with bony tubercles. Lateral line strongly arched in front, without accessory branch. Dorsal fin beginning on the snout; anal fin not preceded by a spine; ventral of left side free from the anal, inserted nearly on the ridge of the abdomen, its base broad, the rays well separated. Species sometimes of large size, mostly of the Atlantic. (*βοθος*, deep.)

a. Scales developed, cycloid; no bony tubercles. (*Bothus.**)

1255. B. maculatus (Mitch.) J. & G.—*Sand-flounder; Window-pane.*

Light olive brown, almost translucent, everywhere marbled with paler, and with many roundish irregular blackish blotches; fins spotted. Body broadly rhomboid, very strongly compressed; interorbital area flattish; eye rather large, about equal to snout; teeth in both jaws in one series laterally, in a very narrow band in front; maxillary nearly half length of head. Gill-rakers rather long and slender, numerous, about 25 below the angle of the arch. Scales well developed,

*=*Lophopsetta* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 216: type *Pleuronectes maculatus* Mitchill.

cycloid, loosely imbricated; those of the blind side a little smaller; no bony tubercles; vertical fins scaly. Anterior rays of dorsal elevated, branched, with free tips. Head $3\frac{3}{4}$; depth $1\frac{3}{5}$. D. 65; A. 52; Lat. l. 85. L. 18 inches. Atlantic coast of United States, very common northward; size rather small.

(*Pleuronectes maculatus* Mitch. Rept. in Part Fish. N. Y. 1814, 9: *Pleuronectes aquosus* Mitch. Trans. Lit. & Phil. Soc. i, 389, 1815: *Rhombus aquosus* Günther, iv, 411: *Lophopsetta maculata* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 216.)

450.—CITHARICHTHYS Bleeker.

(*Hemirhombus* Bleeker: *Orthopsetta* and *Metoponops* Gill.)

(Bleeker, in Günther, iv, 420, 1862, and in Compt. Rend. Acad. Sci. Amsterdam, xiii, 1862: type *Citharichthys cayennensis* Bleeker.)

Eyes and color on the left side. Body oblong; mouth of the large type, but comparatively small, with one or two series of small, sharp teeth in each jaw; no teeth on vomer or palatines. Gill-rakers moderate, slender. Dorsal fin beginning just in front of eye; all the fin rays simple; ventrals of colored side on the ridge of the abdomen; no anal spine; caudal fin convex or double-truncate behind. Scales thin, slightly ctenoid. Lateral line nearly straight, simple. Lower pharyngeals separate, each with a single row of teeth. (*Citharus*, an allied genus; *ἰχθύς*, fish—a fish which lies on its *κίθαρος* or ribs—that is, on its side.)

a. Teeth in upper jaw in two rows. (*Hemirhombus** Bleeker.)

b. Interorbital space broad; left pectoral filamentous.

1256. C. aramaca (Cuv.) J. & G.

Light-brown, with blackish blotches; fins mottled; left pectoral barred. Body elliptic-ovate, the anterior profile regularly decurved, forming an angle above the snout. Mouth rather large, arched; maxillary $2\frac{2}{3}$ in head, extending to below eye; teeth in upper jaw in two series, some of the outer forming small canines; lower teeth in one row. Eye large, 4 in head; lower eye in advance of upper, especially in the adult; interorbital space broad, concave, as broad as eye in adult, much narrower in the young. Gill-rakers short, flattish. Dorsal rather low, the longest rays $2\frac{1}{4}$ in head; anal without spine; pectoral of left side with two filamentous rays, its length $1\frac{1}{4}$ to 2 times head. Scales small, thin, weakly ciliate, with smaller ones intermingled. Head $3\frac{2}{3}$; depth

* Bleeker MSS. Günther, Cat. Fish. Brit. Mus. iv, 423, 1862: type *Hemirhombus guineensis* Bleek. (*ἐμι*, half; *ῥομβος*, *Rhombus*.)

$2\frac{2}{5}$. D. 81; A. 63; Lat. l. 53 (Lat. l. 70, *Günther*). West Florida to Cuba; abundant in deep water.

(*Pleuronectes aramaca* Cuvier, Règne Anim.: *Hemirhombus aramaca* Gthr. iv, 422: ?*Hemirhombus fuscus* Poey, Syn. Pisc. Cub. 1868, 406.

aa. Teeth in both jaws in single series (*Citharichthys*).

1257. C. sordidus (Grd.) Gthr.

Dull olive brownish of varying shade, the males with dull orange spots and blotches; each scale with a darker edge; dorsal and anal fins in the male blackish, with dull orange blotches, and edged anteriorly with yellowish; female paler, the fins nearly plain. Form elliptical; interocular space concave, scaly, a conspicuous sharp ridge above the lower eye; mouth not large, the maxillary about 3 in length of head; teeth anteriorly subequal, growing much smaller behind. Gill-rakers about 16 below the angle. Lower pharyngeals narrow, each with one row of slender teeth. Scales rather large, thin, and membranaceous, readily deciduous, their edges slightly ciliate; accessory scales numerous. Eye large, much longer than snout, $3\frac{1}{2}$ in head; depth of caudal peduncle less than one-third head; pectorals long, nearly two-thirds length of head. Head $3\frac{3}{5}$; depth $2\frac{1}{3}$. D. 95; A. 77; Lat. l. 70. Coast of California north, to Vancouver Island; very abundant; a small, soft-fleshed, dull-colored species.

(*Psettichthys sordidus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 142; Günther, iv, 421; Lockington, Proc. U. S. Nat. Mus. 1879, 83: *Metoponops cooperi* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 198: *Orthopsetta sordida* Gill.)

1258. C. spilopterus Günther.

Olive brownish, usually with large blotches of darker; a series of distant, obscure, blackish blotches along the basal portions of the anal and dorsal fins. Body ovate. Mouth small, very oblique, the gape curved; maxillary $2\frac{2}{3}$ times in length of head, reaching beyond middle of orbit; snout projecting; eyes small, even, shorter than snout, about 6 in head, separated by a narrow ridge, which is concave and scaleless anteriorly; teeth all small; front teeth of upper jaw wide-set, much larger than the posterior, which are close together and very small; teeth of lower jaw few, wide apart. Gill-rakers short and strong, 13 below angle. Pectorals short, less than half length of head. Scales large, those on middle of sides posteriorly largest. Head $3\frac{1}{2}$; depth $2\frac{1}{10}$. D. 80; A. 61; Lat. l. 45. Size small. Tropical America, north to Florida and Louisiana (here described from specimens obtained at Panama).

(Günther, iv, 421; Günther, Trans. Zoöl. Soc. Lond. 1866, 471: *Citharichthys microstomus* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 223.)

1259. C. arctifrons Goode.

Light brown. Body comparatively elongate. Scales cycloid, deciduous. Lateral line sharply defined, straight. Eye 4 in head; interorbital space very narrow, its width 4 in snout; maxillary 3½ in head. Dorsal fin beginning above front of upper eye, its greatest height more than half the length of the head; anal beginning below axil of pectoral; caudal triangular, subsessile, as long as head; rays of vertical fins all much exserted; pectorals inserted very low, that of the colored side being twice the length of the other. Head 4; depth 2½. D. 83; A. 67; P. 10 (left), 7 (right); Lat. l. 40. L. 6 inches. Gulf Stream, off the coast of Rhode Island; abundant. (*Goode.*)

(Goode, Proc. U. S. Nat. Mus. 1880, 341.)

1260. C. unicornis Goode.

Ashy gray, with dark lateral line; eyes black. Body comparatively deep, its greatest height over the pectorals. Scales thin, deciduous. Eye 3 in head, equal to snout, and more than twice the interorbital space, which has a strong ridge; maxillary less than half length of head; teeth minute, close-set, in a single series, stronger on the blind side. A strong, sharp spine on the snout at the anterior termination of the ridge at lower margin of upper eye. Highest rays of dorsal half length of head; caudal pointed, triangular, subsessile; pectoral of left side twice as long as the eye, not half longer than right pectoral. Head 4; depth 2. D. 74; A. 60; P. 4 (right), 10 (left); Lat. l. 40. L. 3 inches. Gulf Stream, off the coast of Rhode Island. (*Goode.*)

(Goode, Proc. U. S. Nat. Mus. 1880, 342.)

451.—HIPPOGLOSSUS Cuvier.

Halibut.

(Cuvier, Règne Anim. ii, 1817: type *Pleuronectes hippoglossus* L.)

Eyes and color on the right side. Form oblong, not strongly compressed. Mouth wide, oblique; teeth in the upper jaw in two series, those below in one; anterior teeth in upper jaw, and lateral teeth in lower, strong; no teeth on vomer or palatines; lower pharyngeal teeth in two rows. Dorsal fin beginning above the eye, its middle rays elevated, the posterior rays of dorsal and anal bifid; caudal fin lunate; ventral fins both lateral. Scales very small, cycloid; lateral line with a strong curve in front. Gill-rakers few, short, compressed, wide-set. Vertebræ 16 + 34. Largest of the flounders; the single species abound-

ing in the Northern seas. (The ancient name, from ἵππος, horse; γλῶσσα, tongue.)

1261. H. vulgaris Fleming.—*Halibut.*

Nearly uniform dark brown; blind side white. Body comparatively elongate, not strongly compressed, deep mesially, thence rapidly tapering each way; head broad; eyes large, separated by a very broad flattish area; lower eye slightly advanced; mouth large, the maxillary reaching middle of orbit. Head $3\frac{3}{4}$; depth 3. D. 105; A. 78. In all Northern seas, south to France, Cape Cod, and San Francisco. One of our most important food-fishes, reaching a weight sometimes of 400 pounds.

(*Pleuronectes hippoglossus* L. Syst. Nat.; Fleming, Brit. Anim. 1828, 197; Günther, iv, 403: *Hippoglossus americanus* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 220.)

452.—PLATYSOMATICHTHYS Bleeker.

(*Reinhardtius* Gill.)

(Bleeker, Comptes Rendus Acad. Sci. Amsterd. xiii, 1862: type *Pleuronectes pinguis* Fabricius = *Pleuronectes hippoglossoides* Walbaum.)

Eyes and color on the right side. Body more or less elongate, compressed; head long and large; mouth large; maxillary reaching beyond eye; jaws with strong, unequal teeth; the upper with 2 series in front, these converging behind; lower jaw with a single series of strong, distant teeth; no teeth on vomer or palatines. Gill-rakers few, short, stout, and rough. Fins rather low; caudal fin lunate. Lower pharyngeal teeth in 1 row. Scales small, cycloid; lateral line without anterior curve. One species known. (πλατυς, flat; σῶμα, body; ἰχθύς, fish.)

1262. P. hippoglossoides (Walbaum) Bean.—*Greenland Halibut.*

Yellowish brown. Snout more than twice as long as the orbit, the diameter of which is one-eighth the length of the head; eyes even in front; interorbital space flat, scaly, wider than the orbit; lower jaw prominent; length of maxillary $2\frac{1}{2}$ in head; teeth conical, pointed; upper jaw with 2 series, convergent posteriorly; those of the outer series gradually smaller posteriorly; a pair of strong canine teeth anteriorly in the inner series, the other teeth of this series being very small; lower jaw with a series of strong, distant teeth. Gill-rakers short, thick, and strongly dentate. Fins naked. Longest dorsal rays one-third length of head; no anal spine; dorsal and anal rays all simple, the dorsal beginning over posterior third of the eye. Scales

very small, not ciliated. Head 4; depth 3. D. 100; A. 75. Greenland to Cape Cod, common northward, reaching a very large size.

(*Pleuronectes hippoglossoides* Walbaum, Artedi, Pisc. 1792, 115: *Hippoglossus grœnlandicus* Günther, iv, 404.)

453.—ATHERESTHES Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 51: type *Platysomatichthys stomias* J. & G.)

Eyes and color on the right side. Body very long and slender, closely compressed, tapering into a long and slender caudal peduncle; head elongate, narrow; mouth extremely large, oblique, the long and narrow maxillary extending beyond the eye; both jaws with 2 irregular series of sharp, unequal, arrow-shaped teeth, some of them long and wide-set, the others short and close-set, sharp; the long teeth freely depressible. Gill-rakers numerous, long, slender and stiff, strongly dentate within. Scales rather large, thin, and readily deciduous, slightly ciliated; those on the blind side similar, smooth; lateral line without arch. Fins low and fragile. Dorsal commencing over the eye, its anterior rays low, the posterior rays somewhat forked; no anal spine; pectorals and ventrals small, both of the latter lateral; caudal lunate. (*αθηρ*, arrow; *οδων*, tooth; from the arrow-shaped teeth.)

1263. A. stomias Jordan & Gilbert.

Plain olive brown, the margins of the scales darker; blind side dusted with black points. Head long, the snout protruding, somewhat truncate at tip; mouth excessively large; the maxillary more than half the length of the head, and reaching behind the eye; teeth in upper jaw anteriorly in a single series, long, slender, and wide-set, much smaller and closer-set behind; on sides of jaw the teeth are very small, and in 2 distinct series, the inner of which corresponds to the single series in front, the teeth thus gradually increasing in size forwards; teeth in inner series of lower jaw very sharp and slender, longer than the upper teeth, wide-set, alternating with shorter, depressed teeth; outside of these larger teeth is a series of fixed small teeth; all of the long teeth in both jaws depressible and conspicuously arrow-shaped towards their tips; inner series of small teeth in upper jaw also arrow-shaped, depressible; eye large, $4\frac{3}{4}$ in head; interorbital space scaly, ridged, not a third the width of the eye. Gill-rakers long and strong, about 17 in number (in total), the longest more than half the diameter of the eye. Upper eye with its range entirely vertical. Scales extremely thin, irregular in size, not

evenly imbricated; lateral line very prominent. Dorsal fin beginning just behind the middle of the eye; caudal peduncle nearly as long as the pectoral fin, about two-fifths the length of the head. Head $3\frac{2}{5}$; depth $3\frac{1}{3}$. D. 103; A. 86; Lat. l. 135. San Francisco to Alaska, in deep water; reaching a length of 2 feet.

(*Platysomatichthys stomias* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 301.)

454.—PARALICHTHYS Girard.

(*Pseudorhombus* Bleeker: *Ancylopsetta*, *Chænopsetta*, and *Uropsetta* Gill: *Xystreurys* J. & G: *Hippoglossina* Steindachner.)

(Girard, U. S. Pac. R. R. Surv. Fish. 1858, 146: type *Paralichthys maculosus* Girard.)

Eyes and color on the left side (except in *Paralichthys maculosus* and *Paralichthys liolepis*, reversed examples of which species are about as common as sinistral ones). Body oblong; mouth large, oblique; each jaw with a single row of usually slender and sharp teeth, which are more or less enlarged anteriorly; no teeth on vomer or palatines. Gill-rakers various. Scales small, ctenoid or cycloid; lateral line simple, with a strong curve anteriorly. Dorsal fin beginning above or before the eye; both ventrals lateral; caudal fin double truncate, or double concave, its middle rays produced; no anal spine. Species numerous, found in all warm seas. (παραλλελος, parallel; ἰχθύς, fish.)

1264. P. californicus (Ayres) J. & G.—*Monterey halibut; Bastard halibut.*

Grayish brown, uniform, or mottled with blackish and pale, the head sometimes sprinkled with black dots; young brownish, with bluish spots. Body rather long and thickish; head small; eye small, little wider than the broad, flattish interorbital space; maxillary as long as pectoral, half length of head, reaching beyond eye; teeth slender, sharp, rather long, the canines moderate. Scales small, finely ciliate, each scale surrounded by narrow, accessory scales; scales on blind side similar; fins with ctenoid scales. Dorsal low, beginning over front of upper eye. Gill-rakers very long and slender, numerous, as long as eye, 23 below the angle. Lower pharyngeals narrow, with small, slender teeth. Anal spine small, concealed. Head $3\frac{3}{4}$ to $4\frac{1}{4}$; depth $2\frac{2}{3}$. D. 70; A. 55; Lat. l. 100. Body indifferently dextral or sinistral. Coast of California; abundant southward; an important food-fish, reaching a weight of 60 pounds.

(*Paralichthys maculosus* Girard, Proc. Acad. Nat. Sci. Phil. 1854, 147, young (not *Rhombus maculosus* Cuvier, which is also a species of *Paralichthys*): *Paralichthys maculosus* Girard, U. S. Pac. R. R. Surv. Fish. 147: *Paralichthys maculosus* Günther, iv, 431: *Hippoglossus californicus* Ayres, Proc. Cal. Acad. Nat. Sci. 1859, 29: *Paralichthys maculosus* and *Uropsetta californica* Gill, Proc. Acad. Nat. Sci. Phil. 1864, 197: *Pseudorhombus californicus* Günther, iv, 426.)

1265. P. ophryas J. & G. (sp. nov.)

Color brownish gray, mottled with darker; fins dusky, with round, dark blotches. Body moderately elongate, thickish; mouth not very large, oblique; each jaw armed with a single row of large, sharp, wide-set teeth, the front teeth enlarged and canine-like, about 8 on each side of lower jaw; lateral teeth of upper jaw minute, close-set; chin prominent; maxillary not reaching beyond eye, scarcely half length of head. Diameter of eye about equal to length of snout, $5\frac{1}{4}$ in head. Dorsal fin low, beginning over front of eye, its first rays about 5 in head; anal spine obsolete. Gill-rakers rather long and slender, 5 + 14 in number, the longest two-thirds eye, $3\frac{3}{4}$ in maxillary, their length 4 to 5 times their breadth at base. Scales very small, not ctenoid, with few accessory smaller ones; curve of lateral line $4\frac{1}{3}$ in straight part. Interorbital space a rather narrow bony ridge, anteriorly naked, not wider than pupil (in specimen 8 inches long), the ridge extending backward, forming a conspicuous elevated rim behind upper eye. Pectoral about half length of head; caudal $\frac{4}{5}$. Head $3\frac{3}{4}$; depth $2\frac{1}{4}$. D. 88; A. 67; Lat. l. 90. One specimen known; from Charleston, S. C.

1266. P. dentatus (L.) J. & G.—*Common flounder.*

Blackish olive, mottled and blotched with darker; fins similarly marked, the pectorals more or less distinctly barred. Body oblong, moderately compressed; mouth wide, oblique, the mandible very heavy and much projecting; 8 to 10 teeth on each side of lower jaw, the two anterior teeth very long; anterior teeth of upper jaw strong, but smaller than those in the lower jaw; the lateral teeth very small and close-set. Eyes small, shorter than snout, about one sixth length of head, and in the adult as wide as the broad, flattish, scaly, interorbital area; the latter is much narrower in the young. Scales small, cycloid; accessory scales few. Gill-rakers lanceolate, dentate, stoutish, wide-set, much shorter than eye, the longest $2\frac{1}{2}$ times as long as broad at base, $5\frac{1}{2}$ in in maxillary, about 2 + 10 in number; pectoral fin about as long as maxillary, which extends beyond eye, and is rather more than half length of head. Dorsal low, its anterior rays somewhat exserted, but short; caudal double concave, the middle rays produced. Anal spine obsolete; ventrals small. Fins all scaly. Head $3\frac{2}{3}$; depth $2\frac{1}{3}$. D. 88 (85 to 93); A. 66 (65 to 73); Lat. l. about 100. New England to Texas and West Indies; everywhere one of the commonest species.

(*Pleuronectes dentatus* L. Syst. Nat. i, 458: *Platessa ocellaris* Dekay, New York Fauna, Fish. 1842: *Pseudorhombus dentatus* and *P. ocellaris* Günther, iv, 425–430: *Chænopsetta*

ocellaris Gill, Proc. Acad. Nat. Sci. Phil. 1864, 218: *Pleuronectes melanogaster* Mitchill, Trans. Lit. and Phil. Soc. N. Y. (doubled example): *Platessa oblonga* Dekay, New York Fauna, Fish. 1842, 299, pl. 48, f. 156, not *Pleuronectes oblongus* Mitch.: *Pseudorhombus oblongus* Günther, iv, 426: *Pseudorhombus dentatus* Goode & Bean, Proc. U. S. Nat. Mus. 1879, 123.)

1267. P. albigutta J. & G.

Dark olive, mottled with dusky, and marked by numerous more or less distinct pale spots, which are sometimes obsolete. Body moderately elongate, elliptical; mouth large, the maxillary reaching past lower eye, its length half head; teeth rather strong, slender, about 7 on each side of lower jaw; 3 or 4 moderate canines in front of upper jaw; the lateral teeth being minute, close-set; interorbital space narrow, scaled posteriorly, the upper ridge prominent behind upper orbit; eye $5\frac{3}{4}$ in head. Gill-rakers broad, the longest $2\frac{1}{2}$ in eye; about 10 below angle. Fins low; anterior rays of dorsal not elevated nor exserted; the longest rays behind the middle, $2\frac{3}{4}$ in head; caudal rounded, $1\frac{1}{3}$ in head. Scales moderate, cycloid. Lateral line with a high curve, its length $3\frac{1}{3}$ in straight part. Head $3\frac{1}{3}$; depth $2\frac{2}{5}$. D. 77 (75 to 80); A. 60 (59 to 61); Lat. l. 90 (pores). South Atlantic and Gulf coast, rather common; readily distinguished from *P. dentatus*, by the smaller number of fin rays.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

1268. P. squamilentus J. & G.

Brownish; body and fins spotted with darker; caudal mottled with white; pectorals banded, with dark spots. Body deep, strongly compressed; caudal peduncle very short. Head wide, the eyes large, wide apart. Mouth very large, oblique, the broad maxillary reaching well beyond pupil, its length more than half the head. Lower jaw projecting; teeth few, unequal, in a single row, about 8 in each jaw canine-like, the two in front of lower jaw longest; lateral teeth of upper jaw minute. Interorbital space flat, scaly, nearly as broad as eye. Scales very small, smooth, adherent; curve of lateral line $4\frac{1}{3}$ in straight part. Gill-rakers short, 3 + 9 in number, triangular, roughly toothed, little higher than wide, the longest nearly half eye. Dorsal beginning over front of eye, the anterior rays $4\frac{1}{2}$ in head; pectoral short, shorter than maxillary. Anal spine obsolete. Caudal double-rounded. Head $3\frac{2}{5}$; depth 2. D. 78; A. 59; Lat. l. 123 (pores). West coast of Florida to South Carolina.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

1269. P. oblongus* (Mitch.) J. & G.

Grayish, thickly mottled with darker and somewhat translucent; four large, horizontally-oblong, black ocelli, each surrounded by a pinkish area; one just behind middle of the body below the dorsal, one opposite this above anal; two similar smaller spots below last rays of dorsal and above last of anal. Body comparatively elongate, strongly compressed. Eyes large, nearly 4 in head, separated by a prominent narrow, sharp ridge. Upper jaw with very numerous small, close-set teeth laterally, and 4 or 5 canines in front; the lateral teeth abruptly smaller than the anterior; each side of lower jaw with 7 to 10 teeth. Chin prominent. Maxillary narrow, reaching past middle of pupil, $2\frac{1}{4}$ in length of head. Gape curved. Scales weakly ctenoid or cycloid. Gill-rakers thick, rather long, few, about 8 below angle. Dorsal low, beginning over front of eye, some of the anterior rays exserted, but not elongate; the longest rays behind middle of fin, not quite half head. Caudal $1\frac{1}{4}$ in head; pectoral $1\frac{3}{5}$. Anal spine obsolete. Head 4; depth $2\frac{1}{4}$. D. 72; A. 60; Lat. l. 93. (D. 79; A. 59, according to Mitchill; D. 86; A. 76, according to Storer). Atlantic coast, northward; not abundant.

(*Pleuronectes oblongus* Mitchill, Trans. Lit. and Phil. Soc. i, 391, 1815: *Platessa quadrocellata* Storer, Proc. Bost. Soc. Nat. Hist. 1847, 242, and in Hist. Fish. Mass. 397, pl. xxxi, f. 3.)

1270. P. ommatus Jor. & Gilb. nom. sp. nov.

Brownish olive, with four large, oblong, ocellated spots, the first above the arch of the lateral line; the three posterior forming an isosceles triangle, the hindmost being on the lateral line. Body oval, compressed, very deep; an abrupt angle above eye. Mouth very small, the maxillary reaching to below middle of orbit, $2\frac{1}{2}$ in length of head; teeth comparatively small, about 14 on each side of lower jaw; no

*A specimen in our collection from Wood's Holl, Mass., provisionally referred to this species, shows the following characters:

Brownish, somewhat mottled, without traces of ocelli (possibly faded); fins similar. Body rather elongate, slenderer than in other species and more compressed; mouth rather large, oblique, the lower jaw not projecting, the maxillary $2\frac{1}{3}$ in head, reaching to opposite posterior border of pupil; about 12 teeth on each side of lower jaw, the anterior rather long, about equal to anterior teeth of upper jaw; lateral teeth of upper jaw becoming gradually smaller posteriorly, much larger, less numerous, and more widely set than in other species of this genus. Eyes large, longer than snout, 4 to $4\frac{1}{2}$ in head, separated by a narrow, elevated, bony ridge, narrower than pupil; anteriorly scaleless, and curved behind the upper eye posteriorly. Scales moderate, cycloid, rather thin; curve of lateral line $4\frac{3}{4}$ in straight part. Gill-rakers 2 + 8 in number, rather long and slender, about $4\frac{1}{2}$ in maxillary. Dorsal beginning above middle of eye, its anterior rays not longer than others; the middle rays a little longer than longest of anal, which are about half head; caudal as long as head; anal spine obsolete; ventrals small; pectoral $1\frac{3}{4}$ in head. Head $4\frac{1}{6}$; depth $2\frac{3}{5}$. D. 77; A. 63; Lat. l. 90. L. about 14 inches.

strongly differentiated canines in either jaw. Eyes moderate, separated by a very narrow, sharp, scaly ridge. Gill-rakers very short, thick, few in number; about 8 below angle, the longest less than one-half diameter of pupil. Scales rather small, very strongly ctenoid, those on blind side also rough; curve of lateral line rather low. Dorsal beginning in front of pupil, its anterior rays long and filiform, much exserted, the third ray half head; caudal short and rounded, $1\frac{2}{7}$ in head; ventral fin of colored side elongate, as long as pectoral, half length of head. Anal spine wanting. Head $3\frac{2}{3}$; depth $1\frac{2}{3}$. D. 70; A. 55; Lat. l. about 85. South Atlantic and Gulf coasts; not common.

(*Ancylopsetta quadrocellata* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 224, not *Platessa quadrocellata* Storer, which is also a species of *Paralichthys*: *Pseudorhombus quadrocellatus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1878, 370.)

1271. P. liolepis Jor. & Gilb.

Color olive brown, mottled with darker; sometimes with very distinct round black blotches; vertical fins blotched with dark; pectoral of colored side with oblique bars. Body elliptical ovate, broad and compressed, its curves regular; mouth small, very oblique, the lower jaw included; maxillary reaching about to pupil, $2\frac{2}{3}$ in head; eyes rather large, $4\frac{1}{2}$ in head, separated by a very narrow, blunt scaly ridge; teeth small, conical, blunt, in a single row; those in lower jaw subequal, close-set; those upper jaw more distant, decreasing in size backwards; teeth $\frac{12+13}{14+15}$. Gill-rakers very short, broad, and strong, minutely serrate on inner margin, about seven below angle, the longest scarcely one-fourth as long as the eye. Scales small, oblong, cycloid, the smaller accessory scales extremely numerous; branchial arches and skin of the shoulder girdle with small, cup-shaped, tubercular scales. Dorsal rather high, firm, low in front, highest near the middle of the body; caudal peduncle very short and deep, its depth 4 times its length. Pectoral of eyed side falcate, usually much longer than head, its length varying considerably. Anterior nostril of blind side with a long flap. Head $3\frac{4}{5}$; depth $1\frac{5}{6}$. D. 80; A. 62; Lat. l. 123. L. 15 inches. Coast of Southern California; indifferently dextral or sinistral.

(*Xystreurys* liolepis* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 34.)

455.—HIPPOGLOSSOIDES Gottsche.

(*Psettichthys* Girard: *Pomatopsetta* Gill.)

(Gottsche; Wiegmann's Archiv. 1835, 168: type *Hippoglossoides limanda* Gottsche = *Pleuronectes platessoides* Fabricius.)

Eyes and color on the right side (except sometimes in *H. elassodon*).

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*Jordan & Gilbert l. c.: type *X. liolepis* J. & G. (ξυστρον, raker; ευρυς, wide.)

Body oblong, moderately compressed; mouth rather large, with one row of sharp teeth on each jaw, besides which, in the upper jaw, is often an inner row of small teeth; no teeth on vomer or palatines; gill-rakers rather long and slender; scales ctenoid; lateral line nearly straight, simple, or with an accessory dorsal branch. Dorsal fin low in front, beginning over or before the eye; ventrals both lateral; caudal double truncate, produced behind. Species found in the Northern seas. (*ἱππογλωσσος*, Hippoglossus; *ειδος*, resemblance.)

a. Lateral line simple; dorsal beginning above eye.
b. Upper jaw with one series of teeth. (*Hippoglossoides.*)

1272. H. platessoides (Fabricius) Gill.—*Rough Dab.*

Reddish brown, nearly plain. Body ovate; mouth moderate, oblique; maxillary narrow, reaching to below pupil, $2\frac{2}{3}$ in length of head; teeth rather small, conical, larger anteriorly, in one row in each jaw, those in the lower largest. Eyes rather large, the upper longer than snout, $4\frac{1}{3}$ in head; lower jaw included, but with a projecting knob at the chin. Snout thick, scaly; interorbital space narrow, with a raised, obtuse ridge, entirely covered with rough scales in about 6 series; mandible with a series of scales. Gill-rakers rather short and robust, not toothed, about ten below angle; longest raker less than one-third length of eye; fins with small, rough scales; a strong pre-anal spine; pectoral not quite half length of head. Head $3\frac{3}{4}$; depth $2\frac{1}{2}$. D. 88 (80 to 93); A. 70 (64 to 75); Lat. l. 90 (pores). North Atlantic; abundant northward on both coasts. Southern specimens (var. *limandoides*) have, as a rule, a smaller number of fin-rays than northern specimens.

(*Pleuronectes platessoides* Fabricius Fauna Grœnlandica, 1780, 164: *Pleuronectes limandoides* Bloch. Ausl. Fische, iii, 24, tab. 106: *Pomatopsetta dentata* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 217: *Hippoglossoides limandoides* Günther, iv, 405: *Hippoglossoides dentatus* Günther, iv, 406; Collett, Norske Nord-havs. Exp. Fiske, 1880, 144.)

1273. H. classodon Jor. & Gilb.

Brownish, nearly uniform, sometimes spotted with darker; fins grayish, irregularly blotched with dusky. Body oblong-elliptical; caudal peduncle about as long as deep; mouth rather large, the gape curved; lower jaw projecting, with a symphyseal knob; maxillary narrow, reaching beyond middle of pupil, $2\frac{1}{2}$ in head; teeth small, close-set, nearly uniform, in a single row. Gill-rakers slender, smooth, about 16 below arch, the longest nearly half diameter of orbit. Eyes large, separated by a narrow, knife-like ridge, which is naked or with a single series of scales. Scales small, firm, rough, those on tail roughest, those

on blind side similar, mostly smooth anteriorly. Anal preceded by a spine; caudal long; pectoral of eyed side half length of head; ventral reaching past front of anal; pectoral and ventral of eyed side with prickle-like scales. Head $3\frac{1}{2}$; depth $2\frac{1}{2}$. D. 77–84; A. 59–64; V. 6; scales 45–100–40. L. 18 inches. Body sometimes sinistral. Puget Sound to Alaska; rather common. Very closely allied to the preceding species.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 278.)

aa. Upper jaw with 2 rows of teeth.

c. Scales small, firm.

1274. H. jordani Lockington.

Olive brown, nearly uniform; membrane of dorsal and anal fins clouded with darker. Body broadly elliptical. Dorsal and ventral outline equally and regularly curved. Mouth oblique, the jaws about even, the symphyseal knob but little projecting; gape curved; maxillary broad, reaching to behind pupil, $2\frac{2}{3}$ in head; teeth in 2 series in the upper jaw, the inner series small and distant from the outer, which is considerably enlarged in front; lower jaw with a single series similar to the outer series in the upper jaw, but larger. Gill-rakers roughish, strong, about 15 below angle, the longest about half as long as eye. Lower pharyngeals rather narrow, each with a single row of sharp teeth. Eyes large; interorbital space a narrow, blunt, scaly ridge. Dorsal beginning over anterior margin of pupil, the rays all simple; caudal fin with the middle rays slightly produced; anal preceded by a spine; pectoral half length of head. Scales of colored side small, firm, strongly ciliated, nearly uniform over head and body; lower jaw and snout scaleless; scales on blind side smooth. Head $3\frac{1}{3}$; depth $2\frac{1}{2}$. D. 94; A. 72; Lat. l. 96. L. 20 inches. Point Concepcion to Puget Sound; abundant; an important food-fish.

(Lockington, Scientific Press Supplement, April, 1879, i, 20; Lockington, Proc. U. S. Nat. Mus. 1879, 73.)

cc. Scales rather large, thin, and deciduous.

1275. H. exilis Jor. & Gilb.

Pale olivaceous brown, with dark points, forming edgings on each scale; bronze spots sometimes present; fins mostly dusky; dorsal and anal edged anteriorly with yellowish; ventrals largely yellow. Body slender, compressed, the flesh soft; mouth not large, very oblique, the gape curved; lower jaw scarcely projecting, with a knob at symphysis; maxillary rather narrow, reaching middle of pupil, $2\frac{2}{3}$ in length of

head; teeth small, slender, close-set, nearly uniform; above in 2 series, below in 1. Eyes large, separated by a sharp, scaly ridge; lower eye advanced. Scales comparatively large, thin and deciduous, ctenoid, but not so rough as in the other species; those on blind side similar, less rough. Lateral line prominent. Fins low, fragile; anal preceded by a spine; caudal fin long, rather pointed; pectorals small, the right pectoral little more than half length of head. Gill-rakers short, slender, toothed, 9 below angle, the longest about one-third diameter of orbit. Head 4; depth $3\frac{1}{4}$. D. 78; A. 62; V. 6; scales 16–71–18. L. 12 inches. A small, weak species, abundant in deep water, from San Francisco to Alaska.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 154.)

aa. Lateral line with an accessory dorsal branch; teeth in one row; dorsal beginning before eye. (*Psettichthys** Grd.)

1276. P. melanostictus (Grd.) J. & G.

Grayish brown, finely speckled with darker on body and fins. Body not very deep, elliptical; mouth rather small, the maxillary extending to below pupil, $2\frac{3}{7}$ in head; teeth large, in a single series in each jaw, those in lower jaw largest; a few large canines in the front of each jaw. Eyes very small, separated by a broad, flat, scaly space, without ridge; lower eye slightly in advance of upper. Gill-rakers rather stout, weak, hooked at tip, 14 below the angle. Scales very small, ctenoid on colored side. Lateral line nearly straight, with a long accessory dorsal branch. Dorsal commencing in advance of upper eye, the anterior rays elevated, slender and exserted, the longest about one-third length of head. First ray of dorsal nearly free from its membrane. Pectoral fin short, $2\frac{1}{3}$ in head; anal fin preceded by a spine; caudal large, strongly convex. Lower pharyngeals very narrow, each with one row of sharp recurved teeth. Head 4; depth $2\frac{1}{3}$. D. 85; A. 60; Lat. l. 112. Puget Sound to Point Concepcion, common.

(*Psettichthys melanostictus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 140: *Psettichthys melanostictus* Günther, iv, 420: *Psettichthys melanostictus* Lockington, Proc. U. S. Nat. Mus. 1879, 73.)

456.—PLEURONICHTHYS Girard.

(*Heteroprosopon* Bleeker.)

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 139: type *Pleuronichthys cœnosus* Girard.)

Eyes and color on the right side. Body deep; head short, with very

*Girard, Proc. Acad. Nat. Sci. Phila. 1854, 140: type *Psettichthys melanostictus* Girard. ($\psi\epsilon\tau\tau\alpha$, flounder; $\iota\chi\theta\upsilon\varsigma$, fish.)

short, blunt snout; mouth small, with several series of slender, acute teeth, which are most developed on the blind side, and are often wanting in one or both jaws on the colored side; no teeth on vomer or palatines; lips thick, with several lengthwise folds, within which is a series of short fringes. Lower pharyngeals narrow, each with a double row of very small teeth. Gill-rakers wide-set, very short and weak. Lateral line nearly straight, with a dorsal branch in our species. Scales small, cycloid, non-imbricate, imbedded. Dorsal fin anteriorly twisted from the dorsal ridge toward the blind side; anal fin preceded by a spine; caudal fin convex behind. Intestinal canal elongate. Herbivorous species, feeding chiefly on algæ. Pacific Ocean. (*πλευρον*, side; *ἰχθυς*, fish.)

a. Dorsal fin beginning on the level of the lower lip; interocular ridge with blunt or sharpish tubercles.

1277. P. decurrens J. & G.

Color brownish, usually much mottled with chocolate and grayish, often finely spotted with brownish on body and fins. Eyes very large, $3\frac{1}{2}$ in head; a blunt tubercle in front of upper eye, another at each end of the narrow interorbital ridge, the posterior largest, but usually not spine-like; two or three above the latter behind the upper eye; some prominences above the opercle; a band of teeth on the right side of the lower jaw, similar to that on the blind side, but narrower. Vertical fins high, the longest dorsal and anal rays two-thirds the length of the head. Dorsal beginning very low, on level of end of maxillary, its first nine rays on the blind side. Head $3\frac{2}{3}$; depth $1\frac{4}{5}$. D. 72; A. 46 L. 12 inches. Coast of California; rather common in deep water.

(*Pleuronichthys cœnosus* Lockington, Proc. U. S. Nat. Mus. 1879, 97: *Pleuronichthys quadrituberculatus* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 50, *nec* Pallas; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 453.)

aa. Dorsal fin beginning on the level of the upper lip.

b. Interocular ridge posteriorly with a strong, backward-directed spine.

1278. P. verticalis Jordan & Gilbert.

Color dark olive brown, mottled with lighter and darker, sometimes with light grayish spots; middle of sides often with a dark spot ocellated with light olive, this again surrounded by darker; fins light, often tinged and margined with reddish, and mottled with blackish. Eyes large, $3\frac{1}{2}$ in head; a tubercle in front of each eye, and one at anterior end of interorbital ridge; posterior end of ridge with a strong, sharp, backward-directed spine; a tubercle behind upper eye; right side of lower jaw without teeth. Dorsal and anal fins lower than in *P. decur-*

rens, the longest rays $1\frac{2}{3}$ length of the head; dorsal fin beginning opposite or slightly below the premaxillary, about five rays being on the blind side. Head 4; depth $1\frac{7}{8}$. D. 65–72; A. 45–48. Coast of California; not rare.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 49.)

bb. Interorbital ridge without distinct spine.

1279. P. cœnosus Girard.

Color light brown, blotched with chocolate color and yellowish, sometimes nearly plain, but usually profusely mottled; sometimes with ocellated blotches, sometimes with the light colors replaced by purplish red. Interorbital ridge prominent, but without spine or conspicuous tubercles, the tubercles of the other species being represented by slight elevations. Vertical fins very high, the longest rays of dorsal and anal two-thirds the length of the head. A narrow band of teeth on the colored side of the lower jaw. Dorsal fin beginning on the level of the premaxillary, its first five rays on the blind side; caudal longer than head. Head $4\frac{1}{4}$; depth $1\frac{3}{4}$. D. 68; A. 48–50. San Diego to Alaska, not generally common, but widely distributed; usually in deep water.

(Girard, Proc. Acad. Nat. Sci. Phila. 1854, 139: *Parophrys cœnosus* Günther, iv, 456.)

457.—HYPSOPSETTA Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1864, 195: type *Pleuronichthys guttulatus* Grd.)

Eyes and color on the right side. Body broad, ovate, rhomboid; mouth very small; teeth slender, equal, acute, in several series; lips thick, not plicate. Lateral line nearly straight, with an accessory dorsal branch. Scales small, smooth. Dorsal fin beginning on the dorsal ridge, not turned to the blind side; anal spine present; caudal fin convex. Gill-rakers little developed. (*ὑψί*, deep; *ψεττα*, flounder.)

1280. H. guttulata (Grd.) Gill.—*Diamond Flounder; "Turbot."*

Brown, with numerous pale-bluish blotches in life, these disappearing in spirits; blind side white, with a strong tinge of yellow along profile of head; fins plain, sometimes with black specks. Body very deep, somewhat angulated near middle of back and belly; eyes moderate, separated by a flattish, raised area; head without spines or tubercles; scales of opercular region little developed; those of blind side reduced; no teeth on right side of either jaw. Accessory lateral line long, half length of body. Anal spine small; pectorals about half length of head; ventrals rather short; caudal peduncle much deeper

than long; caudal large, nearly as long as head. Head $3\frac{3}{4}$; depth $1\frac{2}{3}$. D. 68; A. 50; Lat. l. 95. L. 12 inches. A variable species. Coast of California; abundant.

(*Pleuronichthys guttulatus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 137: *Pleuronectes guttulatus* Günther, iv, 445: *Parophrys ayresi* Günther, iv, 456; Gill, Proc. Acad. Nat. Sci. Phila. 1864, 195: *Pleuronichthys guttulatus* Lockington, Proc. U. S. Nat. Mus. 1879, 94.)

458.—PLEURONECTES* Linnæus.

Plaices.

(*Platessa* Cuvier: *Platichthys* and *Parophrys* Girard: *Lepidopsetta*, *Myzopsetta*, *Liopsetta*, and *Euchalarodus* Gill: *Clidoderma* and *Pseudopleuronectes* Bleeker: *Limanda* Gottsche: *Flesus* Moreau.)

(Artedi; Linnæus Systema Naturæ: type *Pleuronectes platessa* L.)

Eyes and color on the right side (except in *P. stellatus*, which is indifferently dextral or sinistral). Body ovate, elliptical, compressed; head moderate, sometimes tuberculate; mouth small, the small, narrow maxillary reaching front of eye or beyond; blind side with one (rarely two) series of close-set, conical or incisor-like teeth; colored side of both jaws usually toothless. Scales small, ctenoid or cycloid, often imperfectly imbricated, sometimes tubercular or obsolete. Lateral line nearly straight, or more or less arched anteriorly, simple, or with an accessory branch. Gill-rakers small, widely set. Species very numerous in northern seas. ($\pi\lambda\varepsilon\upsilon\rho\grave{o}\nu$, side; $\nu\acute{\eta}\kappa\tau\eta\varsigma$, swimmer.)

a. Lateral line with an accessory dorsal branch, long or short.

b. Lateral line straight or with a slight arch.

c. Scales mostly cycloid, small, imbricated. (*Parophrys*† Girard.)

1281. P. vetulus (Grd.) J. & G.

Uniform light olive brown; the young somewhat spotted with blackish. Body elongate-elliptical; snout very prominent, much protruding, forming an abrupt angle with the descending profile; depth of head opposite middle of upper eye about equalling distance from middle of orbit to snout; eyes large, separated by a very narrow, high

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* "If we were to attribute to some of the characters the same generic value as in other *Pleuronectidæ*, we should be obliged to establish a genus for almost every species, and to separate fishes which evidently form one natural group" (*Günther*, iv, 438). The curvature of the lateral line is here subject to much variation; the accessory lateral line, characteristic of so many Pacific species, disappears by degrees, while the gradations in dentition and squamation are so numerous as to be apparently useless for generic characters. We are unable to follow Dr. Günther in referring to *Pleuronectes*, the species of *Glyptocephalus* and *Cynicoglossus*, which seem to us to represent a well-differentiated type.

†Girard, Proc. Acad. Nat. Sci. Phila. 1854, 139: type *Parophrys vetulus* Girard. ($\pi\alpha\rho\alpha$, near together; $o\phi\rho\upsilon\varsigma$, eyebrow; in allusion to the narrow interocular space.)

ridge; eye large, 4½ in head, the upper with vertical range; mouth very small; maxillary not reaching pupil; teeth trenchant, small, and rather narrow, widened at tip; about 45 teeth on left side of lower jaw; few teeth on right side of lower jaw. Accessory lateral line long. Pectoral about half length of head; caudal truncate, 1½ in head. Fin rays entirely scaleless. Scales on body all cycloid, those on cheeks often slightly ciliated. Head 3½; depth 2½. D. 74 to 86; A. 54 to 68; Lat. l. 105 (tubes). Santa Barbara to Alaska; an abundant species.

(*Parophrys vetulus* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 140: *Parophrys vetulus* Günther, iv, 455: *Pleuronectes digrammus* Günther, iv, 445: *Parophrys hubbardi* Gill, Proc. Acad. Nat. Sci. Phila.1862, 281.)

cc. Scales everywhere strongly ctenoid, well imbricated. (*Isopsetta** Lock.)

d. Scales closely imbricate; accessory lateral line long.

1282. P. isolepis (Lockington) J. & G.

Color brownish, mottled and blotched with darker. Body elliptical, much compressed, moderately deep, the curvature very regular; head moderate, strongly compressed, the profile little depressed above the eye; eyes rather large; interorbital space broad, flattish, with several series of scales. Scales on cheeks similar to those on body, rather large, ctenoid, and closely imbricated. Mouth comparatively large; maxillary reaching pupil, 3⅔ in head; teeth not large, about $\frac{11+14}{9+24}$, conical, close-set, in one somewhat irregular series, or partly in two series; those on colored side small. Lower pharyngeals each with a double row of bluntish teeth. On the blind side the scales are more or less ctenoid, sometimes smooth; those on the cheeks weakly ctenoid; most of the opercle, the preopercle, interopercle, and subopercle on blind side naked. Lateral line with a very slight arch in front, the depth of which is less than one-fifth the length; accessory branch nearly as long as head. Fins rather low, mostly covered with ctenoid scales. Head 4; depth 2¼. D. 88; A. 65; Lat. l. 88. L. 12 inches. Point Concepcion to Puget Sound; rather common in deep water. This species bears some resembrance to *Hippoglossoides melanostictus*.

(*Lepidopsetta umbrosa* Lockington, Proc. U. S. Nat. Mus. 1879, 106 (not of Girard): *Lepidopsetta isolepis* Lockington, Proc. U. S. Nat. Mus. 1880, 325.)

dd. Scales loosely imbricate; accessory lateral line very short.

1283. P. ischyrus J. & G.

Light olive brown, vaguely clouded with light and dark; fins reddish brown; a few roundish dusky blotches on dorsal and anal; pectoral and

*Lockington MSS.: type *Lepidopsetta isolepis* Lock. (ἰσος, equal; ψεττα, flounder.)

caudal tipped with dusky; blind side white, immaculate, or with small round rusty spots; left side of head sometimes rusty tinged. Body oblong, robust; caudal peduncle rather long; snout projecting; forming an angle with the profile; mouth oblique, the chin projecting; teeth $\frac{5+25}{10+22}$, narrowly incisor-like, bluntish, in a single, rather close-set series; maxillary reaching past front of orbit, $5\frac{2}{3}$ in head; eyes large; interorbital space rather broad, scaly, continuous with a ridge above opercle. Head mostly covered with scales like those of the body, but smaller and rougher. Gill-rakers feeble. Lower pharyngeals each with two rows of coarse blunt teeth. Scales thick and firm, adherent, not closely imbricated; those in front well apart; all the scales strongly ctenoid; blind side with similar scales, almost as strongly ctenoid. Vertical fins mostly scaly. Lateral line conspicuous, its scales less rough than the others; a distinct short accessory lateral line on both sides, extending to about the tenth dorsal ray, less than one-sixth head; a series of pores around lower eye behind. Dorsal beginning over pupil, its anterior rays low; its highest rays nearly half length of head; caudal large, double truncate; pectoral of right side about half head. Head $3\frac{1}{4}$; depth 2. D. 70 to 76; A. 52 to 57; V. 6; Lat.l. 85. L. 15 inches. Puget Sound.

(*Parophrys ischyrus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 276.)

bb. Lateral line with a strong arch in front; scales rough. (*Lepidopsetta** Gill.)

1284. P. bilineatus (Ayres) Gthr.

Yellowish brown, with numerous round pale blotches. Body broadly ovate, thickish; mouth moderate, turned toward the left side; teeth stout, conical, little compressed, bluntish, in one series, rather irregularly placed. Lower pharyngeals broad, with two rows of blunt teeth. Gill-rakers few, very short, thick and weak, without teeth. Snout projecting; eyes large, separated by a prominent ridge, which, like the cheeks and upper portion of the opercle, is covered with rough stellate scales; lower eye advanced; opercle, subopercle, and interopercle of left side scaly; preopercle naked. Scales rather small, mostly ctenoid, not closely imbricated; those on the blind side smooth; scales on the cheeks and other parts of the head very rough; scales of body smoother and less closely imbricated anteriorly, the degree of roughness variable, northern specimens (var. *umbrosus*) being roughest. Lateral line

*Gill, Proc. Acad. Nat. Sci. Phila. 1864, 195: type *Platichthys umbrosus* Girard = *Platessa bilineata* Ayres. (λεπιδος, scaly; ψεττα, flounder.)

moderately arched anteriorly, with an accessory dorsal branch, which is less than half length of head. Height of arch less than one-third its length. Dorsal beginning over the eye, its anterior rays low; caudal convex; anal preceded by a spine; a concealed spine behind ventrals; rays of dorsal and anal all simple; dorsal and anal somewhat scaly; caudal three-fifths length of head; pectoral half head. Lower pharyngeals broad, each with two rows of blunt teeth. Head $3\frac{3}{5}$; depth $2\frac{1}{8}$. D. 80; A. 60; teeth $\frac{27+7}{25+10}$; Lat. l. 85. L. 20 inches. San Francisco to Alaska; abundant northward. A food-fish of some importance.

(*Platessa bilineata* Ayres, Proc. Cal. Acad. Nat. Sci. 1855, 40: *Pleuronectes bilineatus* Günther, iv, 444: *Lepidopsetta bilineata* Lockington, Proc. U. S. Nat. Mus. 1879, 103: *Platichthys umbrosus* Girard, Proc. Acad. Nat. Sci. Phila. 1856, 136: *Pleuronectes umbrosus* Günther, iv, 454: *Pleuronectes perarcuatus* Cope, Proc. Amer. Phil. Soc. 1873.)

aa. Lateral line without accessory branch.

e. Lateral line strongly arched in front; scales ctenoid. (*Limanda** Gottsche.)

1285. P. ferrugineus (Storer) J. & G.—*Sand Dab.*

Brownish olive, with numerous, irregular, reddish spots; fins similarly marked; left side with caudal fin, caudal peduncle, and margins of dorsal and anal fins lemon yellow. Body ovate-elliptical, strongly compressed; teeth small, conical, close-set, in a single series on each side in each jaw. Snout projecting, forming a strong angle above upper eye, with the descending profile. Gill-rakers of moderate length, very weak, not toothed. Eyes moderate, $4\frac{1}{2}$ in head, the lower slightly in advance of upper, separated by a high, very narrow ridge, which is scaled posteriorly, and is continued backward as an inconspicuous but rough ridge to the beginning of the lateral line. Scales imbricate, nearly uniform, those on right side rough-ctenoid, those on left side nearly or quite smooth; scales on body rougher than on cheeks. Caudal peduncle short, higher than long. Dorsal inserted over middle of eye, its middle rays highest; pectoral less than two-fifths length of head; caudal fin rounded; anal spine present. Lateral line simple, with a rather low arch in front, the depth of which is barely two-fifths the length. A concealed spine behind ventrals; ventral of colored side partly lateral, the other wholly so; anal spine strong. Head 4 in length; depth $2\frac{1}{5}$. D. 85; A. 62; Lat. l. 100. Atlantic coast, chiefly northward.

(*Platessa ferruginea* Storer, Report Fish. Mass. 1839, 141: *Platessa rostrata* H. R. Storer, Bost. Journ. Nat. Hist. vi, 268: *Myzopsetta ferruginea* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 217.)

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* Gottsche, Wiegmann's Archiv. 1835, 100: type *Pleuronectes limanda* L. = *Limanda vulgaris* Gottsche. (*Limanda*, an ancient name of *L. vulgaris;* perhaps from λῖμην, a small bay or creek.)

1286. P. asper Pallas.

Brown, nearly plain, the blind side with tinges of lemon-yellow. Form of *P. bilineatus*. Teeth small, almost conical, on both sides of the mouth; interorbital space narrow, scaly; opercle and preopercle naked below. Gill-rakers very feeble. Pharyngeals not very broad, their teeth bluntish, not paved. Scales small, wide apart, partly imbedded, each one with 1–4 spinules, which are almost erect; anterior scales with 3–4 of these spinules; posterior mostly with 1; scales of blind side smoother; middle rays of dorsal and anal only scaly. No accessory lateral line. Anal spine present; twentieth anal ray and thirty-seventh dorsal ray longest; caudal double truncate. Head $3\frac{1}{2}$; depth 2. D. 69; A. 53. Alaska to Kamtschatka.

(*Pleuronectes asper* Pallas, Zoogr. Ross.-Asiat. iii, 425, 1811: *Pleuronectes asper* Günther, iv, 454: *Limanda aspera* Bean, Proc. U. S. Nat. Mus. 1881, 242.)

1287. P. beani (Goode) J. &. G.

Grayish, mottled with darker; a conspicuous black blotch on the outer rays of caudal on each side. Body elliptical, with angular outlines, strongly compressed; head very short; snout abbreviated; mouth small, subvertical; teeth small, apparently in two rows, chiefly on the blind side of lower jaw; eyes large, as long as mandible; interorbital space very narrow. Dorsal fin beginning about pupil, its rays long, wide apart, exserted; right ventral near the median line. Caudal broad, fan-shaped. Lateral line with an abrupt curve, the length of which is twice its height and about equal to length of head, its scales highly specialized; lateral line on colored side less developed. Scales small, strongly ctenoid on the right side; larger and cycloid on the blind side. Head $5\frac{1}{2}$; depth $2\frac{3}{5}$. D. 64; A. 63; Lat. l. 88, 27 scales in its curve. Deep water off the Rhode Island coast. (*Goode.*)

(*Limanda beani* Goode, Proc. U. S. Nat. Mus. 1880, 473.)

ee. Lateral line without anterior arch.

f. Eyes and color on either side; scales coarse, stellate; lower pharyngeals broad, with paved teeth. (*Platichthys** Grd.)

1288. P. stellatus Pallas.—*California "Flounder."*

Dark brown or nearly black, with lighter markings; fins reddish brown; dorsal and anal with four or five vertical black bands; caudal with three or four black longitudinal bands. Body broad and short, the snout forming a slight angle with the profile; lower jaw projecting; interocular space rather broad, with very rough scales. Large rough

*Girard, Proc. Ac. Nat. Sci. Phila. 1856, 136: type *Platichthys rugosus* Grd. (πλατυς, flat; ἰχθύς, fish.)

scales at base of dorsal and anal rays and on sides of head; similar but smaller scales scattered over the body. Lateral line smooth. Fins without scales; a cluster of bony prominences above opercle. Teeth incisor-like, truncate, rather broad, $\frac{10+15}{12+16}$. Lower pharyngeals broad, with coarse, paved teeth. Head $3\frac{2}{5}$; depth 2. D. 58; A. 42. L. 30 inches. San Luis Obispo to Kamschatka; very abundant northward; one of the largest and most important of the flounders of the Pacific coast.

(Pallas, Nov. Act. Petropol. 1, 347: *Platichthys rugosus* Girard, U. S. Pac. R. R. Surv. Fish. 148; Günther, iv, 443: *Platichthys stellatus* Lockington, Proc. U. S. Nat. Mus. 1879, 91.)

ff. Eyes and color strictly on the right side.

g. Scales not imbricated, usually ctenoid in the male, cycloid in the female; lower pharyngeals broad, with paved teeth. (*Pleuronectes.*)

1289. P. quadrituberculatus Pallas.

Grayish, mottled with paler and with round black spots; fins very dark. Form of *P. glaber*. Mouth very small, with small, incisor-like teeth, rounded at tip. Eyes separated by a narrow ridge; about five small, prominent, conical, obtuse bony tubercles in a row above the opercle, continuous with the direction of the lateral line, which is straight, without accessory dorsal branch; tubercle above opercle largest. Scales small, cycloid in all specimens examined. Anal spine present. Head $3\frac{2}{3}$; depth 2. D. 68; A. 50; Lat. l. 78. Coasts of Alaska and Kamtschatka.

(Pallas, Zoogr. Ross.-Asiat. iii, 423, 1811: *Parophrys quadrituberculatus* Günther, iv, 456; Bean, Proc. U. S. Nat. Mus. 1881, 241: *Pleuronectes pallasi* Steindachner, Ichth. Beiträge, viii, 45, 1879.)

1290. P. glaber (Storer) Gill.

Grayish brown, mottled with darker brown; fins with blackish spots. Body oblong, ovate. Eyes rather small, separated by a naked elevated ridge. Jaws sometimes each with two distinct rows of teeth; the interrupted outer series of truncate, close-set, thickish incisor-like teeth, which are sometimes movable; the inner row of similar teeth more widely set and rather distant from the outer row (and often or generally wanting); about 20 teeth in outer row in lower jaw; right side of both jaws toothless; interorbital ridge continuous with a broad, naked, smoothish, tuberculose ridge, which joins the lateral line. Scales small, distant, non-imbricate, smooth in the female and more or less ctenoid in the male; those on blind side smaller. Fins moderate, somewhat scaly; anterior rays of dorsal low; pectoral a little more than half head; bases of vertical fins not tuberculate. Anal spine present. Lower pharyngeals

separate, broad, with coarse teeth. Head 3½; depth 2. D. 55; A. 40; Lat. l. 70 (pores). L. 10 inches. Atlantic coast; chiefly northward.

(*Platessa glabra* Storer, Proc. Bost. Soc. Nat. Hist. i, 130, 1843, and Fish. Mass. 393, pl. 31, f. 1: *Euchalarodus putnami* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 222—male; Bean, Proc. U. S. Nat. Mus. 1878, 347: *Liopsetta glabra* Gill, Proc. Acad. Nat. Sci. Phila. 1864, 217.)

1291. P. glacialis Pallas.

Dark brown, the fins spotted. Form of *P. glaber*. A roughened ridge above the cheeks and opercles on the eyed side. Eyes separated by a narrow smooth bony ridge. Scales minute, imbedded, non-imbricate, ctenoid in the males, smooth in the females; scales on blind side similar, less developed; scales of lateral line a little larger. Teeth colored, incisor-like, forming an even edge, mostly on blind side. An anal spine; pectorals short. Head 4; depth 2½. D. 56; A. 42. Alaska to Northern Siberia.

(Pallas, Itin. iii, App. 706; Pallas, Zoogr. Ross. Asiat. iii, 424: *Pleuronectes glacialis* Richardson, Fauna, Bor.-Amer. Fish. 258; Bean, Proc. U. S. Nat. Mus. 1881, 241: *Pleuronectes cicatricosus* Pallas, Zoogr. Ross.-Asiat. iii, 424 (♂, D. 59; A. 36): *Pleuronectes franklini* Günther, iv, 442, 1862 (♀, D. 56; A. 37).

gg. Scales well imbricated, strongly ctenoid; lower pharyngeals narrow, with conic teeth. (*Pseudopleuronectes* Bleeker.*)

1292. P. americanus Walbaum.—*Winter flounder; Mud dab.*

Dark rusty brown, spotted or nearly plain; young olive brown, more or less spotted and blotched with reddish. Body elliptical, an angle above eye. Head covered above with imbricated, strongly ctenoid scales similar to those on the body; blind side of head nearly naked; interorbital space rather broad, strongly convex, its width half eye; the space entirely scaled; teeth compressed, incisor-like, and widened towards tips, close-set, forming a continuous cutting edge; some of teeth often emarginate, sometimes movable; right side of both jaws toothless. Highest dorsal rays less than length of pectorals, and more than half length of head; anal spine present. Head 4 in length; depth 2¼. D. 65; A. 48; Lat. l. 83. Coast of New York, northward; abundant.

(Walbaum, Artedi, Pisc. 1792, 113; Günther iv, 443: *Platessa plana* Storer, Fish. Mass. 373.)

459.—GLYPTOCEPHALUS Gottsche.

(Gottsche, Wiegmann's Archiv. 1835, 156: type *Glyptocephalus saxicola* Gottsche=*Pleuronectes cynoglossus* L.)

Eyes and color on the right side. Body extremely elongate, more than twice as long as deep; much compressed. Head very small and

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* Bleeker, Comtes Rendus. Acad. Sci. Amst. xiii, 1862: type *Platessa plana* Storer. (ψεῦδος, false; πλευρὸνήχτης, *Pleuronectes*.)

short; its blind side with many excavations and mucous cavities in the skull, mandible, and preopercle. Mouth very small; teeth moderate, incisor-like, broad, equal, close-set, in a single series; no teeth on vomer or palatines. Gill-rakers short, weak. Lower pharyngeals narrow, with one or two rows of conical teeth. Lateral line nearly straight, simple; scales very small, smooth; dorsal and anal very long, there being more than 90 rays in the dorsal and more than 80 in the anal; caudal fin rounded; anal spine present. Vertebræ in increased number. Northern seas. (*γλυπτός*, sculptured; *κεφαλή*, head.)

1293. G. cynoglossus (Linn.) Gill.—*Craig-flounder.*

Grayish brown; membranes of the fins with dark spots; pectoral of the colored side dark, about half as long as the head. Upper jaw with about 30 teeth; eyes large, separated by a narrow, scaly ridge; opercle adnate to shoulder-girdle for a short distance only. Pectorals very short, not falcate, that of right side about half length of head. Head 5 in length; depth $2\frac{3}{4}$. D. 105 (101 to 112); A. 95 (87 to 99). Lat. l. 125. North Atlantic, on both sides; abundant in deep water northward.

(*Pleuronectes cynoglossus* Linn. Syst. Nat. i, 259, 1758: *Glyptocephalus acadianus* Gill, Proc. Acad. Nat. Sci. Phila. 1873, 361: *Pleuronectes cynoglossus* Günther, iv, 449: *Pleuronectes elongatus* Günther, iv, 450: Collett, Norske Nord-Havs. Exp. 260.)

1294. G. zachirus Lockington.

Uniform brownish, fins darker; blind side everywhere dusted with dark points. Body elongate; snout very blunt; interorbital space a very narrow, scaly ridge; mouth somewhat twisted toward the blind side; teeth on both sides of jaws, broad and compressed, in a single row, forming a blunt, continuous edge; about 34 in the lower jaw. Eyes very large, $3\frac{2}{5}$ in head. Opercle nearly free from shoulder-girdle. Pectoral of the colored side falcate, longer than the head, more than twice as long as the pectoral of the blind side. Body not slimy. Head $4\frac{3}{5}$; depth 3. D. 94 to 106; A. 79 to 89; Lat. l. 138. L. 15 inches. Coast of California; in deep water.

(Lockington, Proc. U. S. Nat. Mus. 1879, 88.)

460.—CYNICOGLOSSUS Bonaparte.

(*Microstomus* Gottsche, preoccupied by *Microstoma*: *Brachyprosopon* Bleeker.)

(Bonaparte, Fauna Italica, 1837, fasc. xix: type *Pleuronectes microstomus* Don.)

This genus agrees with *Glyptocephalus* in the elongate body, long fins, and numerous vertebræ, differing in the absence of the cavernous

structure of the head. Anal spine obsolete. (κυνικος, dog-like; γλῶσσα, tongue.)

1295. G. pacificus Lockington.

Olive brown, with darker blotches; fins blackish; blind side more or less dusky. Body elongate, elliptical; snout not blunt; interorbital space a narrow, scaly ridge; eyes large, 3 in head; mouth very small; teeth large and very broad, forming a continuous cutting edge on blind side only of each jaw; about 10 teeth in lower jaw. Opercle above its angle wholly adnate to shoulder-girdle. Dorsal and anal fins low. Pectoral fins moderate, that of the colored side a little the longer, about two-thirds length of head; ventrals very small. Body excessively slimy in life. Head $4\frac{1}{2}$; depth $3\frac{1}{4}$. D. 102; A. 85; Lat. l. 140. L. 12 inches. Alaska to Monterey; abundant in deep water.

(*Glyptocephalus pacificus* Lockington, Scientific Press Suppl. i, 21, April, 1879: *Glyptocephalus pacificus* Lockington, Proc. U. S. Nat. Mus. 1879.)

461.—ETROPUS Jordan & Gilbert.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 364: type *Etropus crossotus* J. & G.)

Eyes and color on the left side. Body regularly oval, deep and compressed. Head small; mouth very small, the teeth close-set, slender and pointed, somewhat incurved, mostly on the blind side; no teeth on vomer. Eyes small, separated by a narrow, scaleless ridge; margin of preopercle free. Ventrals free from anal, that of colored side inserted on ridge of abdomen, its base rather long. Dorsal fin beginning above eye; caudal double truncate; anal without spine. Scales thin, deciduous, ctenoid on left side, cycloid on blind side. Lateral line simple, nearly straight. Size small. This genus is apparently allied to *Citharichthys*, although the mouth is very small. (ετρον, abdomen; πους, foot; in allusion to the insertion of the ventrals.)

1296. E. crossotus J. & G.

Light brown, with some darker blotches; fins mottled and spotted. Teeth in lower jaw on both sides, in upper on blind side only. Eyes large, separated by a narrow scaleless ridge, which extends above the opercle; edge of preopercle and especially of opercle on blind side fringed with white cilia. Caudal one-fourth longer than head; pectoral of left side three-fifths head; ventral of blind side longest, inserted in advance of the other. Head $4\frac{4}{5}$; depth 2. D. 80; A. 61; V. 6; Lat. l. 68. L. 5 inches. Coast of Louisiana and Texas to Mazatlan and Panama; locally abundant.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1881, 364; 1882, —.)

462.—THYRIS Goode.

(Goode, Proc. U. S. Nat. Mus. 1880, 344: type *Thyris pellucidus* Goode.)

Body elongate, soft, and translucent. Head very short; mouth small, toothless. Eyes sinistral, close together, the lower slightly advanced. Pectorals of blind side smallest; ventrals crowded together on median keel of body, their bases prolonged on this keel. Rays simple; dorsal beginning on the snout; caudal subsessile, almost confluent with dorsal and anal. Scales very thin, easily detached, probably cycloid. Lateral line well marked, straight. One species known, from deep water. (*θῦρίς*, window, from the translucent body.)

1297. T. pellucidus Goode.

Colorless, translucent; three conspicuous dusky longitudinal lines on left side, the middle one faintest. Two streaks on right side; eyes black. Body thin, pellucid, divided into three longitudinal tracts by depressions at the bases of the rows of interspinous processes. Scales small, thin, caducous. Head very small; eyes small, protruding, their diameter equal to the interorbital space and half the length of the snout; mouth small, formed as in the soles, the upper jaw somewhat hook-shaped. Dorsal fin beginning in advance of the eye, of long, flexible, simple, rays, the tips of which are much exserted. Pectorals inserted far below lateral line, that on blind side as long as orbit, the other as long as snout; ventrals reaching past front of anal. Head 5; depth 3. D. 100; A. 80; P. 12 (left), 4 (right). L. 3 inches. (*Goode.*) Gulf Stream, off the coast of Rhode Island. Perhaps a larva of some species of which the mature form is as yet unknown.

(Goode, Proc. U. S. Nat. Mus. 1880, 344.)

463.—MONOLENE Goode.

(Goode, Proc. U. S. Nat. Mus. 1880, 338: type *Monolene sessilicauda* Goode.)

Body thin, elongate; eyes on the left side, very close together, near the profile; mouth moderate, the length of the maxillary less than one-third that of the head; teeth minute, in a single series, nearly equal on both sides; no teeth on vomer or palatines. Scales rather large, ctenoid on colored side, cycloid on blind side. Lateral line well-marked, that of colored side strongly and angularly curved anteriorly; that of blind side nearly straight. Pectoral of blind side wholly absent; dorsal beginning on the snout, its rays all simple. Caudal fin sessile, almost confluent with dorsal and anal. Ventral fins normal. Gill-rakers few, feeble. Vertebræ 43. Deep-sea fishes. (*μόνος*, single; *ὠλένη*, arm.)

1298. M. sessilicauda Goode.

Ashy brown, with darker brown spots; blind side white; pectoral blackish, with traces of darker transverse bands. Body thin, its thickness not greater than the diameter of the eye; depth 7½ times the diameter of the eye; head everywhere closely thatched with scales even to the edges of the lips. Vertical fins mostly scaly. Lateral line on left side arched, its direction peculiar, the curve having two angles; lateral line on blind side nearly straight. Dorsal beginning on the snout, highest posteriorly, its longest rays half the head; anal beginning close to the vent. Caudal rounded. Pectoral three-fourths length of head. Ventrals on the median line, equal. Head 5; depth 2⅔. D. 99 to 103; A. 79 to 84; scales 23–92–25, 20 in the anterior curve. L. 6 inches. Gulf Stream, off Newport, Rhode Island. (*Goode.*)

(Goode, Proc. U. S. Nat. Mus. 1880, 338.)

464.—ACHIRUS Lacépède.

Soles.

(Lacépède, Hist. Nat. des Poiss. iv, 659, 1802: type *Pleuronectes achirus* L. = *Achirus fasciatus* Lac. = *Pleuronectes lineatus* L.)

Eyes and color on the right side. Body oblong, bluntly rounded anteriorly. Head small; eyes small, close together, the upper eye in advance of the lower; mouth small, somewhat turned toward the colored side; nasal flaps present, the nostril of the blind side fringed; lip of the colored side fringed; teeth very small, on blind side only; gill-openings narrow; the branchiostegal region scaled. Head closely scaled everywhere, the scales on the colored side similar to those on the body, those of the nape and chin much enlarged; scales on the blind side anteriorly, have their pectinations more or less produced, forming cirri; scales of both sides extremely rough, extending on the fins. Lateral line straight, simple; edge of preopercle covered by the scales. Dorsal beginning on the snout, low in front and thickly scaled, its rays divided; anal fin similar, without spine; caudal fin free, convex; caudal peduncle very short and deep; pectoral fin of left side wanting, that of right side small or obsolete; ventral rays 3 or 4, the ventral fin of the colored side long, connected with the anal by a membrane. (ἄχειρ, without hands; *i. e.*, without pectoral fins.)

a. Pectoral fins both obsolete. (*Achirus.*)

1299. A. lineatus (L.) Cuv.

Olive brown, usually with about 6 narrow vertical black cross-lines usually not broader than pupil and with numerous black spots and

clouds; fins with dark spots, some of which form bars parallel with the rays; left side white, usually more or less mottled, sometimes barred. Form oval, the outlines regular. Eyes small, separated by a flattish space wider than eye. A concealed spine in front of upper eye. Scales on nape and chin 3 or 4 times size of others. Fins moderate, scaly on both sides; caudal about as long as head. Head $3\frac{1}{2}$; depth $1\frac{2}{3}$. D. 55; A. 41; V. 4; Lat. l. 75. L. 6 inches. Atlantic coast, common from Cape Cod southward; ascending rivers.

(*Pleuronectes achirus* L. Syst. Nat. ed. 10, i, 268: *Pleuronectes lineatus* L. Syst. Nat. ed. 12, i, 458: *Achirus mollis* Storer, Fish. Mass. 400: *Solea achirus* Günther, iv, 476.)

Subsp. **browni** (Gthr.) J. & G.

Cross-bands broader, as broad as eye; left side immaculate. Gulf of Mexico and southward.

(*Solea browni* Günther, iv, 477.)

465.—APHORISTIA Kaup.

(Kaup, Wiegmann's Archiv. 1858, 106: type *Archirus ornatus* Lacépède.)

Eyes and color on the left side. Body elongate, lanceolate in outline, rounded forward, tapering to a point behind, strongly compressed. Mouth small, unsymmetrical, twisted toward the colored side; teeth small; eyes very small, close together; snout short, not produced, with a hook; lips conspicuous, not evidently fringed; one nostril present, with a slight barbel, just before lower eye. Scales ctenoid, of moderate size, covering the whole body nearly uniformly; edge of preopercle covered by the scales; no lateral line on either side. Dorsal fin low, beginning just behind the snout, confluent with the anal around the tail; pectoral fins obsolete; ventral fin of colored side only present, not continuous with the anal. Gill-openings very narrow. Warm seas. (*ἀφορία*, a dearth; *ἱστος*, a limb.)

1300. A. atricauda Jor. & Gilb.

Olivaceous, with very distinct dark streaks along the rows of scales, and with numerous vertical half-bars; those above lateral line alternating with those below, anteriorly, nearly meeting them behind; vertical fins black posteriorly. Body oblong-lanceolate, comparatively slender, not very blunt anteriorly. Mouth reaching to opposite the eye; lips large; teeth small, present on both sides. Scales small, much smaller on the head; those on blind side similar. Dorsal beginning on the head; ventral well separated from anal. Head $5\frac{1}{3}$; depth $3\frac{1}{3}$. D. 100; A. 80; Lat. l. 105. L. 5 inches. San Diego, Cal.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 23.)

1301. A. plagiusa (L.) J. & G.

Dark brown, with six or seven obscure darker cross-bands, and numerous dark specks and mottlings, forming indistinct stripes; fins all speckled, the caudal not darker than the other fins. Teeth very small, present on both sides of the jaw; eyes very small, close together, the upper in advance, the lower just above angle of mouth. Ventral fin moderately developed, barely reaching anal, to which it is connected by a low membrane. Head 5; depth $3\frac{1}{4}$. D. 95; A. 80; Lat. l. 93. South Atlantic and Gulf coast to the West Indies; abundant in sandy bays.

(*Pleuronectes plagiusa* Linn. Syst. Nat.: *Plagusia plagiusa* Gill, Cat. Fish. E. coast, 794: *Achirus ornatus* Lac. iv, 659: *Aphoristia ornata* Gthr. iv, 490.)

Order V.—PEDICULATI.

(*The Pediculate Fishes.*)

Carpal bones notably elongate, forming a sort of arm, which supports the broad pectorals. Gill-openings reduced to a large or small foramen, situated in or near the axils, more or less posterior to the pectorals. No scales. Ventral fins jugular, if present; first vertebræ united to the cranium by a suture; epiotics united behind supraoccipital; elongate basal pectoral radii reduced in number; no interclavicles; posttemporal broad, flat, simple; superior pharyngeals two, similar, spatulate, with anterior stem and transverse blade; basis of cranium simple. No air-duct to the swim-bladder. Anterior dorsal reduced to a few tentacle-like, mostly isolated, spines. This group is considered as a modified offshoot from *Batrachoid* or *Blennioid* forms. (Latin *pediculatus*, provided with a little foot or pedunele, in allusion to the peculiar pectoral fins.)

(*Pediculati* Günther, iii, 178–205.)

ANALYSIS OF FAMILIES OF PEDICULATI.

a. Gill-openings in or behind the lower axils of the pectorals; mouth large, terminal.
  b. Pseudobranchiæ present; pseudobrachia with two actinosts; head broad, depressed ..... Lophiidæ, 124.
  bb. Pseudobranchiæ none; pseudobrachia with three actinosts.
    c. Ventral fins developed; pectoral members geniculated, with elongate pseudobrachia ..... Antennariidæ, 125 (*a*).
    cc. Ventral fins obsolete; pectoral members not geniculate, with moderate pseudobrachia ..... Ceratiidæ, 125 (*b*).
aa. Gill-openings in or behind the upper axils; mouth small, usually inferior. Malthеidæ, 126.

Family CXXIV.—LOPHIIDÆ.

(*The Fishing Frogs.*)

Head wide, depressed, very large. Body contracted, conical, tapering rapidly backward from the shoulders. Mouth exceedingly large, terminal, opening into an enormous stomach; upper jaw protractile; maxillary without supplementary bone; lower jaw projecting; both jaws with very strong, unequal, cardiform teeth, some of the teeth canine-like, most of them depressible; vomer and palatines usually with strong teeth. Gill-openings comparatively large, in the lower axil of the pectorals. Pseudobranchiæ present. Gill-rakers none. Skin mostly smooth, naked, with many dermal flaps about the head. Spinous dorsal of three isolated, tentacle-like spines on the head, and three smaller ones behind, which form a continuous fin; second dorsal moderate, similar to the anal; pectoral members scarcely geniculated, each with two actinosts and with elongate pseudobrachia; ventrals jugular, I, 5, widely separated. Pyloric cœca present. A single genus, with three or more species, living on sea-bottoms; remarkable for their great voracity.

(*Pediculati* part, genus *Lophius* Günther, iii, 178–182.)

466.—LOPHIUS Linnæus.

Fishing Frogs.

(Artedi; Linnæus, Syst. Nat. 1758: type *Lophius piscatorius* L.)

Characters of the genus included above. (*Lophius*, the ancient name of *L. piscatorius*, from λόφος, a crest.)

1302. L. piscatorius.—*Fishing-frog; Monk-fish; Goose-fish; All-mouth; Bellows-fish; Angler.*

Brownish, mottled, below white; mouth behind the hyoid bone immaculate; pectorals and caudal black at tip; peritoneum black. Body depressed, tapering, scarcely longer than head. Humeral spine with three points, of which the posterior is the longest. Head surrounded with a fringe of barbels; top of head, in young, with many strong spines. Anterior dorsal spine elongate, fleshy at tip. D. I–I–I, III—10; A. 9. L. 3 feet. North Atlantic, on both coasts; generally common, from North Carolina northward. A fish of singular ugliness of appearance.

(Linn. Syst. Nat.; Günther, iii, 179: *Lophius americanus* Cuv. & Val. xii, 380.)

FAMILY CXXV (*a*).—ANTENNARIIDÆ.

(*The Frog-fishes.*)

Head and body more or less compressed. Mouth vertical or very oblique; lower jaw projecting; jaws with cardiform teeth; premaxillaries protractile. Gill-openings small, pore-like, in or behind the lower axils of the pectorals. No pseudobranchiæ. Skin naked, smooth, or prickly. Pectoral members forming an elbow-like angle. Pseudobrachia long, with three actinosts. Ventral fins present, jugular, near together. Spinous dorsal of one to three separated, tentacle-like spines; soft dorsal long, larger than anal. Pyloric cœca none. Genera about 5; species nearly 40. Inhabitants of tropical seas, "living on floating seaweed, and enabled, by filling the capacious stomach with air, to sustain themselves on the surface of the water"; therefore, widely dispersed by currents in the sea.

(*Pediculati* pt. Günther, iii, 182–200.)

a. Head compressed; a rostral spine or tentacle, followed by two larger spines; palatine teeth developed.
b. Dorsal spines disconnected.....ANTENNARIUS, 467.
aa. Head cuboid; a single rostral spine or tentacle; soft dorsal low...CHAUNAX, 468.

467.—ANTENNARIUS Lacépède.

(*Chironectes* Cuv.)

(Commerson; Lacépède, Hist. Nat. Poiss. i, 421, 1798: type *Antennarius chironectes* Commerson.)

Body oblong, compressed, very deep through the occipital region, tapering behind; breast tumid. Mouth rather large, more or less oblique, or even vertical; cardiform teeth on jaws, vomer, and palatines. Eye small. Skin smooth, granular or spinous, with numerous fleshy slips. First dorsal spine developed as a small rostral tentacle; second and third dorsal spines strong, covered with skin, with numerous fleshy filaments; soft dorsal high and long; anal short and deep; caudal fin rounded; pectoral fins moderate, with a more or less slender wrist, at the lower posterior angle of which are the very small gill-openings; ventral fins well developed. Fantastic-looking fishes; very numerous in warm seas. (Latin *antenna*, a feeler or tentacle.)

a. Ventral fins long; skin smooth or nearly so; mouth oblique. (*Pterophrynoides** Gill.)

1303. A. histrio (L.) J. & G.—*Mouse-fish; Toad-fish.*

Yellowish, marbled with brown; 3 dark bands radiating from eye;

* *Pterophryne* Gill, Proc. Acad. Nat. Sci. Phila. 1863, 90: type *Chironectes bougainvillei* C. & V.; preoccupied as *Pterophrynus*: *Pterophrynoides* Gill, Proc. U. S. Nat. Mus. 1878, 216. (πτερον, wing; φρυνη, toad; ειδος, resemblance.) This genus is perhaps worthy of retention.

vertical fins barred with brown; belly and sides with small white spots. Skin of head and body, as well as dorsal fins, with fleshy tags, which are most numerous on the dorsal spines and abdomen. Wrist slender; ventrals large, nearly half as long as head. Dorsal and anal with the posterior rays not adnate to caudal peduncle. Head $2\frac{1}{4}$; depth $1\frac{4}{5}$. D. III–14; A. 7; V. 5. Tropical parts of the Atlantic; abundant on our Gulf coast and occasional northward.

(*Lophius histrio* Linn. Syst. Nat. ed. 10, 237: *Chironectes lævigatus* Cuv. Mem. Mus. iii, 123: *Antennarius marmoratus* Günther, iii, 185: *Pterophryne histrio* Gill, Proc. U. S. Nat. Mus. i, 216, 1878.)

aa. Ventral fins short; skin spinous; mouth vertical. (*Antennarius.*)

1304. A. annulatus Gill.

Fawn-color, lighter below; many black spots ocellated with white both on the body and fins; body with several pink areas, one of which forms a triangular saddle in front of the dorsal and another a broad ring around the base of the caudal fin; angles of mouth with a pink spot. Mouth large, vertical. First dorsal spine slender and straight, terminating in three simple tentacles; third dorsal spine partly imbedded in the skin; wrists and pectorals widened; ventrals short. Skin covered with bifid spines. (*Gill.*) Garden Key, Florida.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 92.)

1305. A. pleurophthalmus Gill.

Brown, marbled with lighter, and with scattered black dots; each side with three large black spots ocellated with brownish; one on dorsal near its base, a second immediately below it on the sides, and a third in the middle of the caudal fin; mouth behind tongue black, with yellow lines. Skin covered with minute bifurcated spines. First dorsal spine terminating in a fringed lobe; second spine longer than the first, its membrane extending nearly to the base of the third spine, the latter nearly free. (*Gill.*) Key West, Florida.

(Gill, Proc. Acad. Nat. Sci. Phila. 1863, 92.)

468.—CHAUNAX Lowe.

(Lowe, Trans. Zoöl. Soc. Lond. iii, 339, 1846: type *Chaunax pictus* Lowe.)

Head very large, depressed, cuboid. Mouth large, subvertical; jaws and palate with cardiform teeth. Skin with minute spines. Spinous dorsal reduced to a small tentacle above the snout; soft dorsal moderate, low; anal short. Muciferous channels conspicuous. Atlantic. (χαύναξ, one who gapes.)

1306. C. pictus Lowe.

Bright orange above; sides rosy; fins vermilion. Rostral tentacle short, pedicellate; muciferous channels, appearing as chain-like rows of pits. Head $1\frac{1}{3}$; depth $5\frac{1}{2}$. D. I–11; A. 5; P. 11; V. 4; C. 7. Deep sea; taken at Madeira and off the coast of Rhode Island.

(Lowe, Trans. Zoöl. Soc. Lond. iii, 339, 1845; Günther, iii, 200; Goode, Proc. U. S. Nat. Mus. 1880, 470.)

Family CXXV (*b*).—CERATIIDÆ.

Head and body compressed. Mouth terminal, more or less oblique. Gill-openings small, in the lower part of the axils. No pseudobranchiæ. Spinous dorsal represented by one or more tentacles. Pectoral members not geniculated, with short pseudobrachia and three actinosts. No ventral fins. Fishes of the open seas, usually inhabiting considerable depths; about 6 genera and 7 or 8 species known. All are uniform blackish in color.

(*Pediculati*, genus *Ceratias*, Günther, iii, 205: *Ceratiidæ* Gill, Proc. U. S. Nat. Mus. 1878, 216.)

a. Mouth moderate.
  b. Gill-arches unarmed; gills $2\frac{1}{2}$ pairs.
    c. Cleft of mouth nearly vertical; skin prickly.
      d. Second dorsal spine developed ..... CERATIAS, 469.
      dd. Second dorsal spine obsolete ..... MANCALIAS, 470.
    cc. Cleft of mouth nearly horizontal; skin smooth; second dorsal spine developed. ONIRODES, 471.
  bb. Gill-arches armed with dentigerous tubercles; gills in $\frac{1}{2}$ $2\frac{1}{2}$ pairs; skin with scattered tubercles; second dorsal spine obsolete ..... HIMANTOLOPHUS, 472.

469.—CERATIAS Kröyer.

(Kröyer, Naturhist. Tidsskrift. 2 række, i, 639, 1844: type *Ceratias holbölli* Kröyer.)

Head and body much compressed and elevated, covered with prickly skin. Mouth wide, its cleft nearly vertical; teeth in jaws conic, movable, of moderate size; no teeth on vomer or palatines. Gills $2\frac{1}{2}$; gill-arches unarmed. Spinous dorsal reduced to two spines, one on the head, the other on the back, the basal element of the second spine exserted; soft dorsal and anal short; pectorals very short, broad, of about 20 rays. Pyloric cœca 2, small. Skeleton soft, fibrous. Greenland. (κερατιας, one that has horns.)

1307. C. holbölli Kröyer.

Black. Caudal fin very long, lanceolate, longer than the trunk (exclusive of head). Cephalic spine reaching, when depressed, beyond

base of caudal; membrane behind dorsal and anal extending nearly to base of caudal. D. I, I, 4; A. 4; C. 8; P. 19. Greenland.

(Kröyer, Naturh. Tidsskr. 1844, 639; Günther, iii, 205.)

470.—MANCALIAS Gill.

(Gill, Proc. U. S. Nat. Mus. i, 227, 1878: type *Ceratias uranoscopus* Murray.

General characters of *Ceratias*, but with the spinous dorsal reduced to a rostral spine, and two fleshy claviform tubercles behind it. Pectoral fins narrow, with about 10 slender rays. (Latin *mancus*, defective, "with a quasi-diminutive termination to correspond with *Ceratias*.")

1308. M. uranoscopus (Murray) Gill.

Uniform black. Anterior spine of first dorsal produced in a long filament, ending in a pear-shaped bulb, terminating in a semi-transparent whitish spot, this spine originating on posterior part of head, and reaching, when depressed, nearly to the tip of tail; far behind this are two short, fleshy tubercles, lying in a depression in front of second dorsal. Teeth moderate, depressible. Skin everywhere with minute, imbedded conical spines. Eyes very small, placed high on the middle of the head. D. I–3 or 4; A. 4; C. 8; P. 10. (*Murray.*) Deep seas; taken at Madeira and off the coast of Southern New England.

(*Ceratias uranoscopus* Murray, in Wyville Thompson, The Atlantic, ii, 67, 1878; Gill, l. c. 228; Goode, Proc. U. S. Nat. Mus. 1880, 469.)

471.—ONIRODES Lütken.

(*Oneirodes* Lütken, Overs. Kong. Dansk. Vidensk. Selsk. Forhandl. 1871, 56: type *Oneirodes eschrichtii* Lütken.)

Head and body compressed, oval, covered with smooth skin. Mouth moderate, almost horizontal; vomer with teeth. Gill-arches unarmed; gills in $2\frac{1}{2}$ pairs. Spinous dorsal represented by a rostral spine, the basal element of which is procumbent and subcutaneous, and a second spine about midway between the rostral spine and the soft dorsal. Greenland. (ὀνειρώδης, dream-like, in allusion to the small, almost covered, eyes.)

1309. O. eschrichti Lütken.

Black; terminal half of the bulb of the cephalic spine whitish. Cephalic spine with a bulbous termination, surmounted by slender filaments, in several transverse rows. Caudal fin shorter than trunk, without head. D. II–4. Deep sea, off Greenland. (*Gill.*)

(Lütken, Dansk. Vidensk. Selsk. Forh. 1871, 57; Gill, Proc. U. S. Nat. Mus. 1878, 218.)

472.—HIMANTOLOPHUS Reinhardt.

(*Corynolophus* Gill.)

(Reinhardt, Dansk. Vidensk. Selsk. Nat. 1837, 74: type *Himantolophus grœnlandicus* Reinhardt.)

Body and head oval, compressed. Skin more or less prickly. Mouth moderate, the cleft oblique, the joint of the mandible below the eyes. Gills in $\frac{1}{2}2\frac{1}{2}$ pairs; gill-arches armed with dentigerous tubercles. Spinous dorsal represented only by a single long rostral spine, the basal element of which is procumbent and subcutaneous. Greenland. (ἱμᾶς, a thong; λοφος, tuft.)

1310. H. grœnlandicus Reinh.

Body oblong-oval. Cephalic ray provided with about 11 tentacles. Depth $2\frac{1}{2}$. D. I–9; P. 12. Greenland. (*Gill.*)

(Reinhardt, l. c. 74; Gill, Proc. U. S. Nat. Mus. 1878, 218.)

1311. H. reinhardti Lütken.

Body short-oval. Cephalic ray $\frac{2}{3}$ length of head, with about 8 tentacles. Skin sparsely covered with thorn-like prickles. Depth $1\frac{1}{3}$. D. I–5; P. 17. Greenland. (*Gill.*)

(Lütken, Kong. Dansk. Vidensk. Selsk. 1878, 321: *Corynolophus reinhardti* Gill, l. c. 219.)

Family CXXVI.—MALTHIDÆ.

(*The Bat-fishes.*)

Head very broad and depressed, the snout more or less elevated, the trunk short and slender. Mouth not large, subterminal or inferior, the lower jaw included; teeth villiform or cardiform. Gill-openings very small, above and behind the axils of the pectoral fins. Body and head covered with bony tubercles or spines. Spinous dorsal reduced to a small rostral tentacle, which is retractile into a cavity under a prominent process on the forehead; in one genus the rostral tentacle is obsolete; soft dorsal and anal fins small and short; ventrals well developed; pectoral fin well developed, its base strongly angled, with long pseudobrachia and 3 actinosts. Branchiostegals 5; no pseudobranchiæ. Genera 3; species about 10; chiefly American.

(*Pediculati* part; genera *Malthe* and *Halieutæa* Günther, iii, 200–205.)

a. Snout produced; teeth on jaws, vomer, and palatines; mouth small.
  b. Rostral tentacle present ..... Malthe, 473.
aa. Snout obtuse; disk orbicular.
  c. Mouth small; rostral tentacle obsolete; teeth on vomer and palatines. Halieutichthys, 474.
  cc. Mouth wide; rostral tentacle present; no teeth on vomer or palatines. Halieutæa, 475.

473.—MALTHE Cuvier.

Sea Bats.

(Cuvier, Règne Animal, ii, 1817: type *Lophius vespertilio* L.)

Body stoutish; head very broad and depressed, triangular in form, the forehead elevated and produced. Mouth rather small, sub-inferior; villiform teeth in bands, on jaws, vomer, and palatines. Skin with conical, bony protuberances. Dorsal and anal fins very small; rostral tentacle present, retractile into a cavity under a bony prominence on the forehead; ventrals present, I, 5, well separated. No air-bladder; no pyloric cœca. Coasts of America. (*μάλθη*, a name of some soft-bodied fish.)

1312. M. vespertilio (Linn.) Cuv.—*Bat-fish.*

Pale grayish brown above, reddish below. Distance between the anterior angles of orbits much less than that between the posterior angles; forehead produced in a sub-conical process, which is variable in length but longer than in the other species, about $\frac{1}{10}$ of total length; rostral groove longer than broad. D. 4; A. 4. L. 6 inches. Atlantic coasts of America, chiefly southward.

(*Lophius vespertilio* Linn. Syst. Nat.; Günther, iii, 200.)

Subsp. **nasuta** (Cuv. & Val.) J. & G.

Dusky above, with round, black spots, edged with whitish. Rostral process short, about one-thirteenth of the length of the body; cavity of rostral tentacle higher than broad; vent behind middle of body; width across arms about half length of body. Head 2. D. 4; A. 4. South Atlantic coast of the United States.

(*Malthæa nasuta* and *notata* Cuv. & Val. xii, 452, 453: *Malthe notata* Lütken Naturh. Foren. Vidensk. Meddels. 1865, 4.)

1313. M. cubifrons Rich.

Rostral cavity somewhat broader than high; distance between anterior angles of orbits about equal to that between the posterior angles; snout not produced beyond the rostral cavity, but with a cylindrical button-like tubercle slightly contracted at base, pointing obliquely upwards and forwards; caudal peduncle very thick and heavy. Head 2; width across arms 2. D. 4; A. 4. Coast of Florida; the original type said to have come from Labrador. Reaches a length of more than a foot.

(Richards, Faun. Bor.-Amer. Fish. p. 103; Günther, iii, 203.)

474. HALIEUTICHTHYS Poey.

(Poey, Proc. Acad. Nat. Sci. Phila. 1863, 89: type *Halieutichthys reticulatus* Poey.)

Disk suborbicular, about as long as the rest of the body (including caudal fin); forehead with a transverse bony ridge, the cavity beneath it being without a tentacle; mouth rather small, inferior, the lower jaw nearly semicircular; teeth fine, on jaws and palate. Dorsal and anal fins with four rays each. (ἁλιευτής, fisher; ἰχθύς, fish.)

1314. H. aculeatus (Mitch.) Goode.

Color gray, reticulated with blackish; caudal with three blackish bands. Disk longer than wide and somewhat narrowed anteriorly; ridges armed with simple spines; five bicuspid spines on each lateral margin of the disk, and between them smaller, simple ones; five spines forming a pentagon before interorbital area; one over each orbit, and 4 on a ridge behind each orbit. D. 4; A. 4. (*Gill.*) Cuba to Southern Florida.

(*Lophius aculeatus* Mitch. Amer. Monthly Mag. ii, 325, 1818: *Halieutichthys reticulatus* Poey MSS., Gill, Proc. Acad. Nat. Sci. Phila. 1863, 91; Goode, Proc. U. S. Nat. Mus. ii, 109, 1879.)

475. HALIEUTÆA Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poiss. xii, 455, 1837: type *Lophius stellatus* Wahl.)

Head very large, broad, depressed, its outline nearly circular; cleft of the mouth wide, horizontal; jaws with small cardiform teeth; no teeth on vomer or palatines. Skin everywhere covered with small, stellate spines. Forehead with a transverse bony ridge, beneath which is a tentacle, retractile into a cavity, the only rudiment of the spinous dorsal fin; soft dorsal and anal very short, far back. Gills $2\frac{1}{2}$, the anterior gill-arch without laminæ. Branchiostegals 5; vertebræ 17. Warm seas. (ἁλιευτής, one who fishes.)

1315. H. senticosa Goode.

Reddish gray, whitish below. Disk orbicular, nearly as broad as long, its outlines prolonged on each side in a strong spine, armed at tip with a group of spinelets; skin above with numerous stout, conical stellated spines, largest posteriorly; a marginal series of close-set spines, besides 5 to 7 on each carpal peduncle; outside of the marginal spines is a row of 5 depressed, knife-like spines, each with a crown of three spinelets; these two rows of marginal spines coalescing on the front edge of disk forming a bristling row, pointing in different directions; small stellate prickles in the interspaces of the larger spines

and on the ventral surface. Snout somewhat projecting, with three multifid spines; a ridge armed with spines across front of eyes over top of snout; four of these spines larger than others; rostral tentacle club-shaped, trilobate at tip; width of mouth equal to distance between centers of eyes. Head $2\frac{1}{2}$; width of disk 2. D. I–6; A. 4; C. 8; P. 14; V. 5. Deep water off southern New England. (*Goode.*)

(Goode, Proc. U. S. Nat. Mus. 1880, 467.)

Order W.—PLECTOGNATHI.

(*The Plectognaths.*)

Scapula suspended to the cranium by a posttemporal; premaxillaries usually coössified with the maxillaries behind, and the dentary bones with the articular; pharyngeal bones distinct; posttemporal coössified with the epiotic and undivided; interoperculum a slender rod; superior pharyngeals laminar, usually vertical and transverse; skin with rough scales or covered with shields or spines, sometimes naked; skeleton incompletely ossified, the vertebræ in small number; ventral fins reduced to a single spine or wanting; air-bladder without pneumatic duct. This group is a modified offshoot from *Acanthopteri*, its nearest relatives being the *Chætodontidæ* and the *Acanthuridæ*. (πλεκτός, braided or plaited; γνάθος, jaw.)

(*Plectognathi* Günther, viii, 207–320.)

ANALYSIS OF FAMILIES OF PLECTOGNATHI.

a. Jaws with distinct teeth.
- *b.* Ventral fins obsolete.
  - *c.* Teeth narrow; body with an immovable carapace of hexagonal plates; no spinous dorsal ..... Ostraciidæ, 127.
  - *cc.* Teeth incisor-like; body with scales or movable plates; spinous dorsal present. Balistidæ, 128.

aa. Jaws each modified into a sort of beak, without distinct teeth; no spinous dorsal.
- *d.* Body little compressed; vertical fins distinct ..... Tetrodontidæ, 129.
- *dd.* Body much compressed; vertical fins more or less confluent around the tail. Orthagoriscidæ, 130.

Family CXXVII.—OSTRACIIDÆ.

(*The Trunk-fishes.*)

Body short, cuboid, triquetrous or pentagonal, covered by a carapace formed of firmly united six-sided plates, the jaws, bases of the fins, and caudal peduncle free and covered by smooth skin. Mouth small; each jaw with a single series of long, narrow teeth. Gill-opening a nearly

vertical slit, below and behind the eye. Dorsal fin single, short, without spine; anal short, similar to dorsal; caudal rounded; no ventral fins; vertebræ 14, the anterior elongate, the last five extremely short; no ribs. Genera two; species about 20; chiefly of the tropical seas. "The locomotion of the trunk-fishes is very peculiar. The propelling force is exerted by the dorsal and anal fins, which have a half rotary, sculling motion, resembling that of a screw-propeller; the caudal fin acts as a rudder, save when it is needed for unusually rapid swimming, when it is used as in other fishes; the chief function of the broad pectorals seems to be that of forming a current of water through the gills, thus aiding respiration, which would otherwise be difficult on account of the narrowness and inflexibility of the branchial apertures. When taken from the water, one of these fishes will live for two or three hours, all the time solemnly fanning its gills, and when restored to its native element seems none the worse for its experience, except that, on account of the air absorbed, it cannot at once sink to the bottom" (*Goode*).

(*Sclerodermi*, group *Ostraciontina*, Günther, viii, 255–268.)

a. Carapace forming a continuous bridge behind anal fin; ventral surface not carinated ..... OSTRACIUM, 475.

476.—OSTRACIUM Linnæus.

(*Ostracion*, Artedi; Linnæus Syst. Nat. x, 330, 1758: type *Ostracion cubicus* Linnæus.)

Trunk-fishes with trigonal, tetragonal, or pentagonal carapace, the ventral surface never carinated; *carapace closed* behind the anal fin. Temperate and tropical seas; the trigonal species confined to the western Atlantic. (*ὀστράκιον*, diminutive of *ὄστρᾰκον*, any hard object, like the shell of a mollusk.)

a. Body three-angled. (*Lactophrys* Swainson.)
b. No supraocular spine.

1316. O. trigonum Linn.—*Trunk-fish.*

Uniform brown, with numerous irregularly grouped whitish spots, most abundant on caudal peduncle; young specimens with a black blotch on sides behind gill-openings. Body three-angled; no spine before eyes. Each ventral ridge with a large, flat spine; dorsal ridge high and sharply compressed, descending rather rapidly forward and ending opposite posterior margin of orbit; carapace open behind the dorsal fin. Head 4 in length; height of sides 2. D. 10; A. 10. West Indies; occasional on our coast southward.

(Linnæus, Syst. Nat. x, 330, 1758; Günther, viii, 256; Goode, Proc. U. S. Nat. Mus. 1879, 276: *Lactophrys trigonus* Poey, Mem. Hist. Nat. Cuba, ii, 362, 1861.)

bb. Supraocular spines present, strong, directed forward. (*Acanthostracium* Bleeker.)

1317. O. quadricorne L.—*Cow-fish; Cuckold.*

Color brown, yellow, blue, or green, with irregular blue blotches; the centers of the scutes often lighter than the margins. Carapace trigonal; adults with a broad low ridge on each side of the back, the dorsal ridge more elevated than in the young, which are somewhat tetragonal. Ventral surface nearly flat; angles of body carinate; a stout spine directed forwards over each eye; abdominal spines flat, directed backward; median dorsal spine seldom present, never persistent; bridges behind dorsal and anal each ending in a flat spine; under side of caudal peduncle with a free plate; carapace closed behind dorsal fin. Head $4\frac{3}{4}$; depth $2\frac{1}{3}$. D. 10; A. 10. Tropical parts of the Atlantic; common on our coast southward.

(Linnæus, Syst. Nat. x, 331, 1758; Günther viii, 257; Goode, Proc. U. S. Nat. Mus. 1879, 278.)

Family CXXVIII.—BALISTIDÆ.

(*The Trigger-fishes.*)

Body oblong, or ovate, more or less compressed, covered with rough scales or scutes of varying structure, the scutes not forming a carapace. Mouth small, terminal, low; jaws short, each with one or more series of separate incisor-like teeth; eye near the occiput; preorbital very deep. Gill-openings small, slit-like, above or in front of the pectoral fins. Dorsal fins two, the anterior of one to three spines, the first spine highest; second dorsal remote from the first, of many soft rays; caudal fin rounded or forked; ventral fins wanting, their place sometimes occupied by a single spine at the end of the very long, usually movable, pubic bone. Genera about 8; species about 100. Carnivorous fishes; inhabitants of the warm seas.

(*Balistidæ*, group *Balistina*, Günther, viii, 211–255.)

a. Dorsal spines three; body covered with thick scales or plates. (*Balistinæ.*)

Balistes, 477.

aa. Dorsal spine single or followed by a rudiment; skin with minute, rough scales. (*Monacanthinæ.*)

b. Ventral spine present; gill-slit short, nearly vertical; anal rays about 30.

Monacanthus, 478.

bb. Ventral spine obsolete; gill-slit long, oblique; anal rays about 40 to 50.

Alutera, 479.

477.—BALISTES Linnæus.

Trigger-fishes.

(Artedi; Linnæus, Systema Naturæ, 1758: type *Balistes vetulus* L.)

Body compressed, covered with thick, rough scales or plates. Both

jaws with incisor-like teeth, usually four on each side, in each jaw. First dorsal of three spines, the anterior of which is much the largest (the third rarely minute or obsolete); second dorsal and anal rather long, similar to each other, often falcate or filamentous in front; caudal fin usually rounded, with the outer rays produced; pelvic bone very long, with a blunt, usually movable spine at its end; no barbels; branchiostegals 6; vertebræ 7 + 10. Species very numerous in the tropical seas. (βάλω, to shoot.)

a. Caudal peduncle compressed; teeth white, uneven, more or less notched; cheeks without naked stripes; larger bony plates behind gill-opening.
b. A groove in front of the eye; tail without spines or tubercles. (*Balistes.*)

1318. B. vetulus L.

Two curved, bluish, dark-edged bands on the side of the head, the lower from the angle of the mouth towards the throat, the upper from above the snout to the root of the pectoral; a black light-edged line, similarly curved below the eye; several other similar lines radiating from the eye; caudal fin margined above and below with bluish, and with an intra-marginal bluish band; dorsal and anal fins with transverse bluish bands; young with some irregular oblique black lines following the rows of scales. Scales on head much smaller and more crowded than those on body; third dorsal spine shorter and weaker than second; caudal fin widely forked, the lobes filamentous and about equal. Head 3; depth $1\frac{4}{5}$. D. III–29; A. 27; Lat. l. 63. Tropical parts of the Atlantic; occasional on our coast.

(Linn. Syst. Nat.; Günther, viii, 215.)

1319. B. capriscus Gmelin.—*Leather-jacket.*

Uniform brownish; second dorsal and anal chequered or marked with interrupted longitudinal brown lines; caudal mottled; young with numerous small dark-brown dots. Third dorsal spine shorter but stouter than the second; plates on head similar to those on the body; caudal lobes produced in the adult; soft dorsal high, its longest rays $1\frac{1}{4}$ in head. Head $3\frac{1}{4}$; depth $1\frac{3}{4}$. D. III–27; A. 25; Lat. l. 51 to 57 (62 in specimens from Italy); about 35 scales in an oblique series from vent upward and forward. Warm seas; occasional northward; common on our Gulf coast and in the Mediterranean.

(Gmelin, Syst. Nat. i, 1471, 1788; Günther, viii, 217: *Balistes fuliginosus* Dekay, New York Fauna, Fish. 1842, 339.)

1320. B. poweli Cope.

Ashy above, pale below; sides everywhere with series of longitudinally oval azure spots; dorsal and anal fins marked with smaller blue

spots. Form elevated, profile convex; scales without prominent spines; two or three scapular plates; first dorsal spine rugose, $1\frac{1}{4}$ in muzzle; third dorsal spine well developed. Head $3\frac{1}{2}$ in total length; depth $1\frac{3}{4}$; D. III–26; A. 22. (*Cope.*) Newport, Rhode Island; a doubtful species (probably strayed from the West Indies).

(Cope, Proc. Acad. Nat. Sci. Phila. 1870, 120.)

478.—MONACANTHUS Cuvier.

(Cuvier, Règne Animal. ii, 1817: type *Monacanthus chinensis* Cuvier.)

Body short and deep, very strongly compressed, covered with minute, rough scales. Mouth very small; upper jaw with a double series of incisor-like teeth, usually six in the outer and four in the inner series; lower jaw with about six incisors in a single series; teeth connivent, unequal; gill-opening a small slit, shorter than the eye, nearly vertical, below the posterior part of the eye, and just in front of upper edge of pectoral. Dorsal spine large or small; second dorsal and anal fins similar to each other, of about 30 rays each; caudal fin moderate, rounded; pelvic bone with a blunt spine; the bone connected by a movable flap of varying size; side of tail often with a patch of spines, especially in the males; no barbel. Vertebræ 7 + 11 to 14. Species very numerous in warm seas. (*μονος*, one; *ἄκανθα*, spine.)

a. Ventral spine movable; dorsal spine with retrorse barbs.

b. Abdominal flap greatly developed, extending beyond the ventral spine. (*Monacanthus.*)

1321. M. occidentalis Günther.

Brownish, mottled with lighter; a broad brown band across the middle of the ventral flap. Scales very small, without median crest. Spines becoming longer on caudal peduncle, which has in addition 2 or 3 pairs of strong spines curved forward, these prominent only in adults; ventral flap longer than head, about $\frac{1}{3}$ length of body. Scales on ventral flap developed as flat plates, with their free margins pectinate. Snout pointed, the upper profile concave. Dorsal spine strong, nearly as long as head, armed behind with 2 rows of retrorse barbs; ventral spine small, rough. Head $3\frac{1}{2}$; depth $1\frac{1}{2}$. D. I–30; A. 30. West Indies; occasional on our southern coasts.

(Günther, viii, 237.)

bb. Abdominal flap moderate, not extending beyond the pelvic spine. (*Stephanolepis** Gill.)

1322. M. broccus (Mitch.) Dek.—*Fool-fish; File-fish.*

Dull-greenish, mottled with darker; fins olivaceous, somewhat

*Gill, Proc. Acad. Nat. Sci. Phila. 1861, 78: type *Monacanthus setifer* Bennett. (*στήφανος*, crown; *λεπίς*, scale.)

blotched. Body rather deep. Jaws subequal; eyes large, more than $\frac{1}{3}$ length of snout. Gill-opening about as long as eye, separated from the eye by an interspace nearly equal to its length. Anterior profile slightly concave. Dorsal spine somewhat shorter than snout, inserted above posterior part of eye, stout, rough, armed behind with 2 rows of retrorse barbs. First ray of soft dorsal said to be sometimes filamentous (not so in our specimens); pectorals small. Pelvic bone long, ending in a short, blunt, movable spine, beyond which the abdominal flap does not extend; length of free edge of flap when expanded not greater than diameter of eye. Scales minute, each with a crest of about 3 prickles, those on caudal peduncle villous, those on the ventral flap larger, elongate; no naked areas; no recurved spines on tail. Head $3\frac{2}{5}$; depth $1\frac{3}{4}$. D. I–32; A. 32. L. 6 inches. Cape Cod to Tropical Seas; abundant on our South Atlantic coast.

(*Balistes broccus* Mitch. Trans. Lit. & Phil. Soc. i, 467, 1815: *Monacanthus broccus*, *massachusettensis*, and *setifer* Dek. N. Y. Fauna, Fish. 1842, 335–337: *Monacanthus massachusettensis* Storer, Fish. Mass. 425: *Monacanthus setifer* (in part) Günther, viii, 240: *Stephanolepis setifer* Gill.)

1323. M. davidsoni Cope.

Brown, with 5 longitudinal bands with pale centres, the upper and lower forming 3 dark blotches at the base of dorsal and anal; head unspotted; caudal with a brown cross-band. Scales with 3 scutes on a common base; longer, slender, recurved spines on tail, in 2 clusters of 3 each; sides with slender scattered filaments. Dorsal spine with strong teeth, its height one-half depth of body. Pelvic plate elongate, spinous all around. Depth $2\frac{1}{5}$. D. I–30; A. 28. Florida Reef. (*Cope.*)

(Cope, Trans. Amer. Phil. Soc. Phila. xiv, 476, 1870.)

1324. M. spilonotus Cope.

Light-brown; some longitudinal lines just below the dorsal fin, the median developing a dark spot below the middle of the soft dorsal. Scales each supporting a pedicle, whose summit divides into 4 or 5 radiating spines. Body elongate; outline of front straight. Dorsal spine long, with simple teeth, $4\frac{1}{4}$ in length of body; dorsal and anal fins medially elevated; no brush or spines on caudal peduncle. Pelvic shield elongate, spinous all around, the movable portion present. Depth $2\frac{1}{2}$; D. I–32; A. 31. Gulf of Mexico. (*Cope.*)

(Cope, Trans. Amer. Phil. Soc. Phila. xiv, 476, 1870.)

aa. Ventral spine fixed; dorsal spine weak, without barbs; abdominal flap moderate. (*Cantherines** Swainson.)

1325. M. pullus Ranz.

Coloration variable, generally with a whitish spot behind the last dorsal ray. Body moderately elevated. Snout moderately produced, with the upper profile slightly concave. Posterior margin of eye directly above axil. Adults with two pairs of strong recurved spines on each side of tail; caudal short. Dorsal spine nearly straight, rather shorter than head, without barbs, situated above the front of eye. Skin with a velvety appearance; the scales minute. Depth about 2. D. I–35; A. 31. (*Günther.*) Tropical Seas, north to Southern Florida.

(Ranzani, Nov. Comm. Act. Sci. Inst. Bonon. v, 4, 1842: ? *Monacanthus pardalis* Rüppell, N. W. Fish. 1855, 57: *Monacanthus pardalis* Günther, viii, 230.)

479.—ALUTERA Cuvier.

File-fishes.

(Cuvier, Règne Anim. ed. 2, ii, 829, 1829: type *Balistes monoceros* Osbeck.)

Body oblong or rather elongate, strongly compressed, covered with minute, rough scales. Mouth and teeth essentially as in *Monacanthus*, but the lower jaw more projecting, so that the lower teeth are directed obliquely upward and backward. Gill-opening an oblique slit, longer than eye, situated below and in advance of eye, its posterior end behind base of pectorals. Pelvic bone long, falcate, movable under the skin, without spine at its extremity. Dorsal spine small, inserted over the eye, rough, but without barbs; soft dorsal and anal long, each of 36–50 rays; caudal fin convex; pectorals small. Species numerous.
(? ἄλουτος, unwashed.)

1326. A. schœpfii (Walb.) Goode.

Dull-greenish, marbled with lighter and darker; lower lip dusky. Eye small, about 4 in snout. Gill-slit nearly twice as long as eye, its upper posterior edge nearly under the middle of the eye. Pectoral fins scarcely half longer than eye. Dorsal spine slender; dorsal and anal fins low; caudal very long in the young, becoming shorter in the adult. Scales minute, shagreen-like, uniform over the body. Head $3\frac{2}{3}$ in length; depth $2\frac{1}{3}$. D. I–36; A. 38. L. 16 inches. Cape Cod to West Indies; abundant southward.

(*Balistes schœpffi* Walbaum, Artedi, Pisc. 1792, 461: *Balistes aurantiacus* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 468, 1815 (adult): *Alutera cuspicauda* Dekay, New York Fauna, Fish. 1842, 338 (young): *Ceratacanthus aurantiacus* Gill (adult).)

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* Swainson, Class. Fish. etc. ii, 327, 1839: type *Cantherines nasutus* Swainson: *Balistes sandwichensis* Q. & G. (κανθος, ass; ῥιν, snout.) (=*Liomonacanthus* etc. Bleeker.)

1327. A. scripta (Osbeck) Bleeker.

Head and body with irregular blue spots and lines, and small, round black spots. Skin finely velvety. Body oblong, its depth equal to distance from snout to posterior margin of orbit. Snout produced, the upper profile concave. Dorsal spine very feeble, above middle of orbit. Part of gill-opening in advance of orbit. Pectoral fin inserted below orbit; caudal elongate, about as long as head; dorsal and anal low. Depth 3. D. 46; A. 50. (*Günther.*) Tropical seas; occasionally north to South Carolina.

(*Balistes scriptus* Osbeck, Itin. i, 144, 1771: *Monacanthus scriptus* Günther, viii, 252.)

Family CXXIX.—TETRODONTIDÆ.

(*The Puffers.*)

Body oblong or elongate, usually little compressed, and sometimes very broad; belly capable of great inflation; skin scaleless, usually more or less prickly, sometimes with strong spines. Teeth in each jaw wholly confluent, forming a sort of beak which in each jaw is sometimes divided by a median suture; lips full; nostrils various. Fins of soft rays only; dorsal fin posterior, opposite and similar to the anal; caudal fin distinct; no ventral fins; pectoral fin short and broad, its upper rays longest. Pelvic bone undeveloped. Gill-openings small, close in front of the pectorals; air-bladder present. Genera about 10; species 80; inhabiting warm seas; noted for their habit of filling the stomach with air. When inflated, the diameter of the belly is often greater than the length of the body.

(*Gymnodontes*, group *Tetrodontina* Günther, viii, 270–316.)

a. Both jaws divided by a median suture. (*Tetrodontinæ.*)
  b. Nostril on each side a single tube, with two openings.
    c. Dorsal and anal falcate, of 12 to 15 rays each ..... Lagocephalus, 480.
    cc. Dorsal and anal of 6 to 8 rays each ..... Tetrodon, 481.
aa. Both jaws entire, without median suture. (*Diodontinæ.*)
    d. Spines very small, flexible, bristle-like, mostly two-rooted. Trichodiodon, 482.
    dd. Spines strong, stiff, erectile, mostly two-rooted ..... Diodon, 483.
    ddd. Spines very strong, immovable, mostly three-rooted. Chilomycterus, 484.

480.—LAGOCEPHALUS Swainson.

(*Gastrophysus* Müller.)

(Swainson, Class. Fish. etc. 1839, 328: type *Tetrodon lagocephalus* L.)

Body comparatively elongate; skin smooth or variously prickly, the prickles most developed on the abdomen; abdomen capable of very

great inflation. Dorsal and anal fins rather long, falcate, of 12 to 15 rays each; caudal lunate. A single nasal tube on each side with two openings near its tip. Jaws each with median suture. Lower side of tail with a fold. (*λαγος*, hare; *κεφαλη*, head, from the incisor teeth).

1328. L. lævigatus (Linn.) Gill.—*Tambor; Smooth Puffer.*

Olive green above, sides and below silvery white. Body elongate, the tail slender. Back and sides smooth; belly prickly, the spinous region oblong, extending from the throat backwards nearly to the vent and on sides nearly as high as base of pectoral fins; spines comparatively large, three-rooted, well separated and with no smaller ones intermixed. Eye large, silvery, 2 in snout, $1\frac{1}{2}$ in the flat interorbital space. Gill-opening midway between snout and front of dorsal. Dorsal and anal fins large and falcate, the last rays rapidly shortened; height of dorsal $1\frac{3}{4}$ in head; caudal fin lunate, the longest ray $1\frac{1}{2}$ in head; fold of skin on sides of tail very distinct, ridge-like. Head $3\frac{1}{4}$. D. 14; depth $4\frac{1}{2}$. A. 12. Tropical seas, north to Cape Cod.

(*Tetrodon lævigatus* L. Syst. Nat. i, 411: *Tetrodon lævigatus* Günther, viii, 274.)

481.—TETRODON* Linnæus.

(*Tetrodon, Leisomus* and *Cirrhisomus* Swainson: *Cheilichthys* Müller: *Anchisomus* Kaup.)

(*Tetraodon* Linnæus, Syst. Nat.: type *Tetraodon testudineus* L.)

Body oblong, usually little elongate; skin variously prickly or smooth, sometimes with cirri. A single nasal tube on each side, with two openings near its tip. Dorsal and anal fins short, little falcate, of 6 to 8 rays each; caudal truncate or rounded. Jaws each with median suture. Species numerous, in warm seas. (*τετρα*, four; *ὀδων*, tooth.)

a. Tail without fold below.

b. Skin almost smooth.

1329. T. politus Girard.

Brown, with very numerous small, round, dark spots above; usually pale curved cross-bars present, in the form of concentric rings, one on middle of back in front of dorsal, inclosing a dark area, another surrounding this, the remainder appearing as bars, anteriorly running downward and backward, posteriorly downward and forward. Skin smooth; spines rudimentary or obsolete, on belly only, imbedded in

*The earliest subdivision of the genus *Tetrodon* seems to be that made by Swainson in 1839. But one Linnæan species (*testudineus*) is retained in the genus by Swainson. The section to which it belongs contains numerous species, and may well retain the original generic name. The value of the subdivisions is doubtful, but they may be retained for the present at least.

wrinkles of the skin; no caudal fold; nasal tentacles distinctly perforate. Interorbital area flat; sides without cirri. Head 3; depth $4\frac{1}{3}$. D. 7; A. 6. San Diego to Panama; very common southward.

(*Tetrodon politus* Girard, U. S. Pac. R. R. Surv. Fish. 1858, 340: *Tetrodon politus* Günther, viii, 281.)

bb. Skin prickly, more or less.

1330. T. testudineus L.

Dark brown above, marbled with lighter; sides to below pectoral fins yellowish brown, marked with many round dark spots; belly and fins immaculate; back, from interorbital region nearly to base of dorsal fin, axils of pectoral and belly nearly to vent covered with minute, imbedded spines. Snout, sides, and tail naked; snout rather produced, the eye being nearer the root of pectoral than tip of snout. Interorbital area generally concave; sides sometimes with cirri; length of caudal equal to its distance from dorsal. Head 3. D. 8; A. 6. West Indies; occasional on our coasts.

(*Tetrodon testudineus* Linn. Amœn. Acad. i, 309, and Syst. Nat i, 309: *Tetrodon testudineus* Günther, viii, 282.)

1331. T. spengleri Bloch.

Dark brown above and on sides to base of pectoral fins; sides below yellowish, with a series of about twelve round dark-brown blotches about as broad as eye; belly white; caudal fin with a brown bar at its base and a broader one at its margin. A patch of minute spines from the occiput half-way to the dorsal fin; belly spinous to near the vent; head, tail, and most of sides smooth; sides usually with numerous small cirri. Snout produced, the eye nearer root of pectoral than tip of snout. Head compressed, narrow; interorbital space slightly concave, very narrow, about half as broad as eye. Head 3. D. 7; A. 6. West Indies; occasional on our coast.

(*Tetrodon spengleri* Bloch, Ausl. Fische. i, 135: *Tetrodon spengleri* Günther, viii, 284: *Cirrhisomus spengleri* Swainson, Class. Fish. ii, 328, 1839.)

1332. T. turgidus Mitch.—*Puffer; Swell Toad; Blower.*

Olivaceous above, marbled with black; belly light orange; sides of body and tail with narrow irregular black cross-bars; an inky blotch below and behind pectoral fin; fins plain. Body about as wide as deep when not inflated; interorbital space slightly concave; profile not very steep, depressed in front of the eyes. Caudal peduncle, lips, and bases of fins smooth; skin everywhere else rough with small three-rooted spines, which are largest on the back and belly. No cirri. Eyes

rather small. Head $2\frac{2}{3}$; depth 3. D. 7; A. 6; C. 7, slightly rounded. L. 12 inches. Atlantic coast. Massachusetts to Texas; very abundant.

(*Tetrodon turgidus* Mitchill, Trans. Lit. & Phil. Soc. i, 473, 1815: *Tetrodon turgidus* Dekay, New York Fauna, Fishes, 327: *Tetrodon turgidus* Günther, viii, 285.)

1333. T. trichocephalus Cope.

Brownish above, faintly vermiculated with lighter; sides yellowish, becoming white below; fins uniform light yellow; a brown spot at base of pectoral. Profile suddenly descending from prefrontal region to pre-maxillary, arched from the former point backward; belly spinous to near vent; dorsal region from a little behind the nares to above the ends of the pectoral fins spinous; spines on the head long, close-set, like seal bristles; caudal fin truncate, with prominent points. Head $3\frac{1}{2}$ in total length; eye $3\frac{1}{2}$ in length of head. D. 8; A. 7. (*Cope.*) Newport, Rhode Island.

(*Tetraodon trichocephalus* Cope, Proc. Ac. Nat. Sci. Phila. 1870, 120.)

482.—TRICHODIODON Bleeker.

Hairy Box-fishes.

(Bleeker, Atl. Ich. Gymnodontes, 49: type *Diodon pilosus* Mitch.)

Body oblong, little depressed; nasal tentacle present; dermal ossifications very small, each with a pair of lateral roots, and each terminating in a fine flexible, bristle-like spine. (τριχίον, hair; διόδων, *Diodon.*)

1334. T. pilosus (Mitch.) Bleeker.

Brownish above, ashy below; spines of a metallic golden color; sides and back with a few oblong blackish-brown spots. Body oblong, cuboid; the skin entirely spinous, except a small space around the mouth and eyes and another on caudal peduncle. D. 12; A. 14. (*Dekay.*) North Atlantic; rare; said to reach a large size.

(*Diodon pilosus* Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 471, 1815: *Diodon pilosus* Dekay, New York Fauna, Fishes, 326; Günther, viii, 316.)

483.—DIODON Linnæus.

Porcupine-fishes.

(Linnæus, Syst. Nat. 1758: type *Diodon hystrix* L.)

Body robust, the belly moderately inflatable. Dermal spines strong, stiff, most of them two-rooted and erectile, a few three-rooted and therefore immovable; both jaws entire; nasal tube simple, with two lateral openings. Pectorals broad, their margin undulate, the upper lobe longest; vertical fins rounded. Warm seas. (δις, two; ὀδων, tooth.)

1335. D. hystrix L.

Back, sides, and fins with numerous small, round blackish spots. Spines strong, dilated at the base, with a pair of basal grooves; post-pectoral spines the longest, about as long as the pectoral fin, those of the posterior part of the back and tail short and broad, three-rooted and therefore not erectile; upper and lower part of the tail with two or three pairs of three-rooted, immovable, recumbent spines; frontal spines moderate. Head 3; depth $3\frac{1}{2}$. D. 13; A. 13. In all tropical seas, north to Lower California and Florida. L. about 3 feet.

(L. Syst. Nat.; Günther, viii, 306: ? *Diodon spinosissimus* Günther, viii, 307.)

1336. D. novemmaculatus Cuvier.

Olivaceous, variously spotted, usually a broad blackish brown band between orbits, extending downward behind the eye; a second parallel to it across the nape; a large transverse subtriangular spot in middle of back; a kidney-shaped spot above pectoral; all these spots usually pale edged; back and sides with small black spots. Spines varying in length; upper part of tail without ossifications, but a pair of spines lying along-side, their base on the side of the dorsal; some tentacles usually present above eye and on throat, abdomen, and back; 14 to 19 transverse series of spines between snout and dorsal. Tropical seas, north to San Diego.

("*Diodon tacheté*" Lacépède, ii, 13: *Diodon novemmaculatus, sexmaculatus, quadrimaculatus*, and *multimaculatus* Cuvier, Mém. Mus. Hist. Nat. iv, 136, 137, 1818: *Diodon maculatus* Günther, viii, 307: *Diodon maculatus* Streets, Bull. U. S. Nat. Mus. vii, 43.)

484.—CHILOMYCTERUS Bibron.

Rabbit-fishes.

(Bibron (*Chilomyctére*, Revue Zool. 1846, 140); Kaup, Wiegm. Archiv. 1855, 232: type *Diodon geometricus* Bloch & Schn.)

Body broad, depressed, moderately inflatable. Dermal spines short, stout, immovable, triangular, each with three roots; nasal tube simple, with two lateral openings; caudal peduncle short; fins small, formed as in *Diodon;* jaws without median suture. (χεῖλος, lip; μυκτήρ, nose. "Narines non closes au sommet, mais chacune ayant l'apparence de deux lèvres, ou formée de deux tentacules réunis à la base.")

1337. C. geometricus (Bloch & Schn.) Kaup.—*Rabbit-fish; Swell Toad.*

Greenish; belly pale; a round, black, ocellated spot above pectorals, not as large as eye, a larger one behind pectorals, another at base of dorsal, with a smaller one below it; back and sides with parallel black stripes of uniform width about as wide as the interspaces, those on the

back running longitudinally, those on the sides obliquely downward and backward, those on the front of the head running crosswise; a dark bar at base of dorsal; other fins plain. Body a little broader than deep at the gill-openings; interocular space broad, concave; eyes large, lateral, nearly as long as snout, each with a cirrus above it, longer than the pupil; gill-opening about as wide as eye, opposite upper anterior part of pectoral. About 9 spines between eye and tail, their height equal to diameter of pupil; spines on belly much smaller, partly imbedded in skin; some of the posterior with cirri; spines on caudal peduncle; anterior root of each spine little if any larger than the others. Pectoral fin deeper than long, the margin undulate, the upper lobe longest. Head $2\frac{3}{4}$; depth 3. D. 12; A. 10; L. 6 inches. Massachusetts to West Indies; very abundant southward.

(*Diodon geometricus* Bloch & Schneider, 1801, 513: *Diodon maculostriatus* Mitchill, Trans. Lit. & Phil. Soc. N. Y. i, 470, 1815; Günther, viii, 310.)

Subsp. (?) **fuliginosus** (Dek.) Goode & Bean.

Dark brownish olive above, with wavy dusky lines; belly black, the bases of its spines bright orange. Entire body covered with large three-rooted spines, which are very numerous and close-set, especially on the belly; spines of the belly as large or even larger than those on back; not imbedded. D. 12; A. 10. Atlantic coast, from Cape Cod southward; not common; probably a young form of the preceding.

(*Diodon fuliginosus* Dekay, New York Fauna, Fish. 324.)

Family CXXX.—ORTHAGORISCIDÆ.

(*The Head-fishes.*)

Body more or less short and deep, compressed, truncate behind, so that there is no caudal peduncle. Skin rough, naked, spinous or tessellated. Mouth very small, terminal; teeth completely united in each jaw, forming a bony beak without median suture, as in *Diodon*. Dorsal and anal fins similar; posterior, more or less perfectly confluent around the tail; no spinous dorsal; no ventral fins; pelvic bone undeveloped; pectorals present. Belly not inflatable; gill-opening small, in front of pectorals; an accessory opercular gill; no air-bladder. Fishes of the open seas, apparently composed of a head to which small fins are attached. Genera 3; species 4. Found in most warm seas.

(*Gymnodontes*, group *Molina* Günther, viii, 317–320.)

a. Skin thin, armed with stout spines; vertical fins not confluent; body deeper than long (*Molacanthinæ*).....MOLACANTHUS, 485.
aa. Skin thick, granular or tessellated; vertical fins falcate, confluent behind. (*Orthagoriscinæ.*)
b. Body not twice as long as deep; skin without hexagonal plates.....MOLA, 486.

485.—MOLACANTHUS Swainson.

(*Pallasia* Nardo: *Acanthosoma* Dekay.)

(Swainson, Class. Fish. etc. ii, 329, 1839: type *Diodon mola* Pallas = *Molacanthus pallasi* Sw. = *Diodon nummularis* Walb.)

Body suborbicular, much compressed, deeper than long, covered by a thin silvery skin on which are many strong spines. Dorsal and anal fins high and short, not confluent, the space on the tail between them occupied by a row of small spines; pectorals moderate. These small fishes have been generally considered as the young of *Mola.* The fact that they are not so was first conclusively shown by Prof. Putnam (Am. Nat. Dec. 1870). The species inhabit the open seas. (Mola; ἀκάνθα, spine.)

1338. M. nummularis (Walb.) Gill.

Olive-brown above; sides and below iridescent silvery. Body vertically oval, higher than long; spines on body scattered, striated on sides. Head more than half length, which is little more than $\frac{2}{3}$ depth. D. 25. (*Dekay.*) Atlantic Ocean; rare on our coast. L. about 2 inches.

(*Diodon nummularis* Walbaum, Artedi, Pisc. 1792, 600: *Acanthosoma carinatum* Dekay, New York Fauna, Fish. 330: *Molacanthus pallasi* Putnam, l. c.)

486.—MOLA Cuvier.

(*Orthagoriscus* Bloch & Schneider.)

(Cuvier, Leçons d'Anat. Comp. 1800 (*fide* Gill): type *Orthagoriscus mola* Bloch & Schneider = *Mola rotunda* Cuvier.)

Body ovate, strongly compressed, covered with a thick, rough, leathery, elastic skin, which is without bony plates. Profile forming a projecting fleshy nose above the mouth. Dorsal fin beginning not far behind pectorals, short and high, falcate, confluent with the anal around the tail; no large spines on the body. Clumsy fishes, found in most warm seas, reaching a great size. (Latin *mola*, a millstone.)

1339. M. rotunda Cuv.—*Sun-fish; Head-fish; Mola.*

Dark gray; sides grayish brown, with silvery reflections; belly dusky; a broad blackish bar running along the bases of the dorsal, caudal, and

anal fins. Dorsal and anal fins high in front, rapidly decreased backwards; caudal fin low, and with a wavy outline. Depth always more than half length, and in the young the vertical diameter exceeding the longitudinal. Form varying much with age, the body becoming more elongate, the fins comparatively shorter, the eye much smaller, and a hump being developed above the mouth, topped by an osseous tubercle. Head 3; depth $1\frac{3}{5}$. D. 17; A. 16. Pelagic, inhabiting most temperate and tropical seas, swimming slowly about near the surface; common northward to Cape Cod and Point Concepcion. It reaches a weight of about 500 pounds.

(*Tetrodon mola* Linn. Syst. Nat.: *Orthagoriscus mola* Bloch & Schneider, 1801, 510: *Orthagoriscus mola* Storer, Fish. Mass. 420: *Orthagoriscus analis* Ayres, Proc. Cal. Acad. Nat. Sci. ii, 31, f. 54: "*Mola rotunda* Cuvier, 1800.")

ADDENDA ET CORRIGENDA.

Page 3 (57). **Branchiostoma lanceolatum.**

To the synonymy of species No. 1, add:

("*Limax lanceolatus* Pallas, Spicilegia Zoöl. x, 19, about 1770.")

Until the Lancelets are more fully compared, neither our Atlantic nor our Pacific coast form can be distinguished from the European species.

Page 5. Instead of *Bdellostoma* read:

3. Polistotrema Gill.

The generic name *Heptatrema* Duméril (Cuvier, Règne Anim.) has priority over *Bdellostoma* Müller. Species 3 may be named—

3. P. stouti (Lockington) J. & G.

The identity of this species, thus far known only from the coast of California from Santa Barbara northward, with the Chilian *H. dombeyi* is doubtful. The description, on page 57, is taken from California specimens. The genus *Polistotrema* Gill (Proc. U. S. Nat. Mus. 1880, 30) is distinguished by the presence of 11 to 14 gill-openings instead of 6 or 7, the base of the tongue being between the seventh and eighth (not anterior) pair of branchiæ.

Page 7. A better generic arrangement of our Lampreys than that given in the text would be as follows (omitting the character of the division of the dorsal fin, which is subject to much individual variation):

a. Maxillary tooth single, crescent-shaped, with a cusp at each end.
b. Lingual teeth pectinate.....4. ENTOSPHENUS* Gill.
bb. Lingual teeth obscurely tricuspidate.....5. AMMOCŒTES† Duméril.
aa. Maxillary tooth of 2 or 3 pointed cusps close together; lingual teeth pectinate.
6. PETROMYZON‡ L.

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*Species *E. tridentatus* (Gairdn.) Gill.

†Including *Lampetra* Gray. Species *A. plumbeus* (Ayres) Bean: *A. aureus* Bean: *A. niger* (Raf.) Jor.: *A appendix* (Dek.) J. & G.

‡Including *Ichthyomyzon* Grd. Species *P. argenteus* Kirt.: *P. castaneus* (Grd.) Bean: *P. marinus* L.: *P. dorsatus* Wilder.

Page 7. The genus 4 (*a*) *Entosphenus* should probably be admitted, and its species should be—

4. E. tridentatus (Gairdner) Gill.

It ranges from Monterey to Vancouver's Island, and Nos. "5" and "6" are not distinct from it.

On page 8, after *Ammocœtes plumbeus*, add:

7 (*b*). **A. aureus** Bean.

Plumbeous above, golden yellow below; under side of head and neck silvery. Maxillary tooth single, bicuspid; mandibulary with 7 cusps, the outer largest. Head shorter than chest; distance from eye to first dorsal thrice base of first dorsal; base of second dorsal twice as long as that of first, the fin twice as high; interspace between dorsals $\frac{2}{3}$ length of head; tail (from vent) 4 in total length. Head $10\frac{1}{3}$ ($5\frac{1}{2}$ in distance to first dorsal). L. 15 inches. Yukon River, Alaska; abundant. (*Bean.*)

(*Ammocœtes aureus* Bean, Proc. U. S. Nat. Mus. iv, 1881, 159: ? *Petromyzon marinus camtschaticus* Pallas, Zoogr. Rosso-Asiat. iii, 1811.)

On page 9, after *Ammocœtes niger*, add:

8 (*b*). **A. appendix** (Dekay) Gill.

Dusky brown, sometimes tinged with bluish; fins pale amber. A ring of irregularly-shaped corneous processes within the mouth, and a large isolated double tooth of the same texture on the inferior portion of the mouth. Origin of dorsal in advance of middle of body (behind middle in *A. niger*). Vent near posterior third of body. Anal papilla ("appendix") conspicuous in males in spring. Streams of New York and Southern New England. (*Dekay.*) Not lately recognized, but apparently differing from *A. niger* in the less posterior dorsal.

(*Petromyzon appendix* Dekay, New York Fauna, Fish. 1842, 381: *Ammocœtes unicolor* Dekay, l. c. 383; larva. Of the remaining species described by Dekay, *Ammocœtes bicolor* Le Sueur, l. c. 383, seems to be the larva of *Petromyzon marinus*, and *P. lamotteni* Le Sueur MSS. l. c. 382, is probably *Petromyzon argenteus*.)

Page 10. *Petromyzon castaneus* has been lately received from Louisiana. It is considered a valid species by Dr. Bean, as is also 9 (*b*), *P. hirudo* (Grd.) Bean. Both these species have the maxillary tooth tricuspid, not bicuspid as in *P. argenteus*.

Page 11. The mandibulary teeth in *Petromyzon marinus* are usually 7 in number. The plates of the anterior lingual pair are confluent, and not their serrations as stated in the text.

Page 11. Instead of *P. nigricans* Le Sueur, read:

12. P. marinus, subsp. **dorsatus** Wilder, sp. nov.

The "*Petromyzon nigricans*" of the Atlantic coast streams seems to be the young of *P. marinus*. The Cayuga Lake Lamprey described in the text on page 11 is apparently a distinct subspecies, differing from *P. marinus* in the longer head (snout $1\frac{1}{3}$ in chest; head half longer than chest; in *P. marinus* snout $1\frac{3}{4}$ in chest; head one-third longer than chest); mandibulary teeth usually 8 or 9. *Males with the back before dorsal fin compressed in a long, hard, fleshy ridge.* Interspace between dorsals variable in length, shortest in males, $\frac{1}{4}$ to $\frac{2}{5}$ base of first. Tail $3\frac{3}{4}$ in length. Coloration of *P. marinus*, and size not much less. Abundant in Cayuga Lake, New York; not yet observed elsewhere. The differences above noted are not very constant.

(Wilder MSS.: *Petromyzon nigricans* J. & G., page 11 of this work.)

Page 14. Under *Echinorhinus* the reference

(Blainville, Bull. Sci. Philomath. 1816, 121)

should be supplied.

Page 18 (and 59). Instead of genus 13 (*b*) *Scyllium* Cuvier read:

13 (*b*).—**SCYLLIORHINUS** Blainville.

(Blainville, Bull. Sci. Philom. 1816, 121: type *Scylliorhinus catulus* Blainville = *Squalus canicula* L.)

The generic diagnosis of "*Scyllium*," on page 59, applies to *Scyllio-rhinus*, with the exception of the clause "nostrils separated by a broad isthmus", which is true of part of the species (subgenus *Catulus* Smith) only. Species 18 (*b*) should be "*S. ventriosus* (Garman) J. & G."

After 18 (*b*), *S. ventriosus*, add:

18 (*c*). **S. retifer** (Garman) J. & G.

Light brownish, crossed at irregular intervals by groups of 2 to 4 narrow black lines, which are joined by other lines, forming a network of polygonal meshes; belly uniform yellowish. Body moderately elongate, the vent in front of its middle. Head depressed, its width nearly equal to its length in front of spiracles; length of snout from mouth less than distance between outer margins of nostrils; nasal valves broader than isthmus between them, not reaching mouth, without free cirrus; length of arch of mouth a little more than half its width; lower labial fold reaching one-fourth distance to symphysis; teeth small, each with a central cusp and two small ones on each side. Pec-

torals short and broad. First dorsal inserted near middle of length of body; caudal not large. (*Garman.*) Deep water, off the coast of Virginia; one specimen known.

(*Scyllium retiferum* Garman, Bull. Mus. Comp. Zoöl. xi, 233, 1881.)

Page 18. Instead of *Galeorhinidæ*, read:

Family VII.—CARCHARIIDÆ.

On page 19, instead of *Mustelus hinnulus*, read:

19. M. canis (Mitch.) Dek.

Add to the synonymy:

("*Squalus canis* Mitch. Trans. Lit. & Phil. Soc. N. Y. i, 486, 1815: *Mustelus asterias* Cloquet, Dict. Sci. Nat. xiv, 407, 1820: *Mustelus plebejus* Bonap. Fauna Italica, 1838, 49.")

Page 20, species 20:

The *Mustelus canis* of our Atlantic coast seems to us to be perfectly identical with the European species, the American name having priority of date. *Mustelus californicus* Gill, is however a different species. It may be thus compared with *M. canis*, the differential characters of the latter species being interposed in parenthesis: In No. 20, *M. californicus* Gill, the dorsal fin is comparatively small (large), its anterior lobe obtuse, and when depressed not reaching so far as (reaching well beyond) the posterior lobe; height of anterior lobe less (more) than the base of the fin, which is little (considerably) longer than snout and less (more) than one-third the interspace between dorsals; the pectoral is comparatively short, not reaching to anterior third (reaching nearly to middle) of dorsal, or about half way to the beginning of the slit between ventrals (half way to the base of the claspers). The snout in *M. californicus* is more pointed, the mouth narrower, its anterior angle more acute (obtuse); breadth between angles of mouth $\frac{2}{3}$ ($\frac{5}{6}$) snout. *Mustelus californicus* reaches a larger size than *M. canis*. In *Mustelus californicus* the embryo is attached to the placentæ. It therefore belongs to the subgenus "*Pleuracromylon*" Gill.

Page 20. The genus "*Rhinotriacis*," introduced on page 59, may be suppressed, "*R. henlei*" being a species of *Triacis*, as given on page 20.

Page 20 (60). 20 (*b*), "*Rhinotriacis lævis*" (or, better, *Mustelus lævis* Risso) should probably be suppressed, as the evidence of its occurrence in our waters is insufficient.

Page 21. After *Galeorhinus* add the reference:

(Blainville, Prodrome Faune Française, Poiss. i, 85, 1816.)

It is probable that our species is really distinct from the European. It may be characterized as—

23. G. zyopterus* J. & G. sp. nov.—*Oil Shark.*

Dusky grayish; most of pectoral, tip of caudal, and anterior portion of both dorsals black. Snout depressed, rather long, but rounded at tip; nostrils considerably nearer mouth than tip of snout; the anterior lobe with a small pointed tip; interorbital space a little less than length of snout; teeth about $\frac{3}{3}\frac{2}{0}$, the four or five teeth nearest the middle of the jaw much smaller than the others; median tooth of each jaw smallest, subtriangular, without basal cusps; lateral teeth of both jaws similar, with their points strongly directed outwards; a sharp angle near the middle of the outer margin, below which are 2 to 5 sharp cusps or serrations; labial folds moderate. Eye large, the small spiracles separated from it a distance about equal to its diameter. Head with many mucous pores. Distance between angles of mouth nearly twice length of mouth, and equal to length of snout from mouth. Pectoral fin moderate, reaching somewhat beyond front of dorsal, its tip somewhat pointed, its free edge concave. Middle of first dorsal nearly midway between pectorals and ventrals, its anterior lobe rounded, posterior, acute; second dorsal scarcely one-fourth as large as first, a trifle larger than anal, which is inserted slightly farther back.

Measurements of a large example, 63 inches in length, from San Pedro, California.

Length	100.	Length of base of first dorsal	7.3
Greatest depth	14.	Height of first dorsal	7.5
Length of head	18.	Distance between dorsals	2.5
Length of snout (from mouth)	7.5	Length of second dorsal	4.5
Length of snout (from eye)	8.	Height of second dorsal	4.
Width of mouth	7.	Length of anal	3.5
Length of spiracle	0.7	Length of caudal	21.
Length of eye	2.5	Distance from pectorals to ventrals	25.
Distance from snout to first dorsal	3.3	Length of pectorals	15.
		Length of ventrals	4.5

Coast of Southern California, from San Francisco to Cerros Island, extremely abundant. Valued for the oil in its liver, and for the fins, which are much prized by the Chinese, the gelatinous fin-rays making a fine soup.

(*Galeorhinus galeus* Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 42, and 1881, 18: typical specimens have been distributed by the National Museum as Nos. 26927,

*ζύος, soup; πτερον, fin.

26973, 27190, and 27391. The European species, *G. galeus*, is said to have the middle teeth of the jaws not reduced in size, the median tooth in each jaw with basal cusps; the second dorsal half smaller than the first; the fins plain, etc.)

Pages 22, 23, 24, 60. The groups called *Carcharinus* and *Eulamia* should rather be considered as subgeneric sections of a single genus, which may stand as—

18.—CARCHARIAS Rafinesque.

(Rafinesque, Indice d'Ittiol. Sicil. 1810, 44: type *Squalus glaucus* L.)

The species of *Carcharias* should stand as follows:

25. C. glaucus (L.) Cuv.

26. C. obscurus (Le Sueur) Müller & Henle.

In this species the very long pectorals extend beyond the end of the dorsal, and their outer margin is four times as long as the inner.

26 (*b*). **C. platyodon** (Poey) J. & G.

Slaty-blue, white below; caudal blackish, other fins with dark tips. Body stout. Head very short, broad, depressed, and bluntly rounded. Mouth twice as broad as long, its breadth about half more than length of snout; inner lobe of nostril very blunt; nostril a little nearer eye than tip of snout; upper teeth very broad, triangular, erect, coarsely serrate, not notched; lower teeth narrower, more finely serrate. First dorsal beginning close behind pectoral, a little higher than long, not falcate, its base $2\frac{1}{3}$ in interspace between dorsals; second dorsal very small, its base 5 in interspace; caudal moderate, $2\frac{2}{3}$ in body; anal a little longer than second dorsal, and placed a little farther back; pectorals rather small, not falcate, 6 in total length, reaching a little past dorsal; width of pectoral nearly two-thirds its length. L. 10 to 15 feet. Cuba to Texas; abundant in the Gulf of Mexico; the specimen here described being from Galveston.

26 (*c*). **C. plumbeus** (Nardo) J. & G.

Bluish gray, whitish below. First dorsal rounded above, inserted immediately above the base of the pectoral; second near the middle of the base of the anal; pectoral one-third longer than broad, its external angle rounded. Mouth arched, its breadth equal to its distance from tip of snout; snout short, rounded, a little longer than in *C. lamia;* eyes small; upper teeth scarcely notched on the outer margin. (*Doderlein.*) Mediterranean; said to have been once taken at New York.

(*Squalus plumbeus* Nardo, Prodr. Ichth. Venice, 1827, 9: *Carcharias* (*Prionodon*) *milberti* Valenciennes MSS. in Müller & Henle, Plag. 38, 1841: *Eulamia milberti* Gill, Proc. Acad. Nat. Sci. 1864, 262, in part: *Carcharias milberti* Doderlein, Manuale Ittiolog. Mediter. 1881, 44.)

This species should probably be omitted from our lists, as there is no good evidence that any of our sharks are identical with the *plumbeus* or the *milberti* of the Mediterranean. Probably *C. cæruleus* was originally confounded with it. The *Eulamia milberti* of recent American writers is probably the following species, which may be substituted, as—

27. C. cæruleus Dekay.

This species differs from C. *platyodon* chiefly in the following respects: Head longer, the snout much less obtuse, its length from mouth equal to breadth of mouth; distance between nostrils $\frac{1}{3}$ less than length of snout. Teeth and fins as in *C. platyodon.* Pectorals rather small, not falcate, $6\frac{1}{2}$ in body; caudal 4, rather narrow. New England to Florida; not rare.

(*Carcharias cæruleus* Dekay, New York Fauna, Fishes, 354, 62; Jordan & Gilbert. Proc. U. S. Nat. Mus. 1882: *Lamna caudata* Dek. l. c. 354: *Eulamia milberti* Gill, Proc, Acad. Nat. Sci. Phila. 1864, 262; probably not *Carcharias milberti* M. & H.)

27 (*b*). **C. lamia** Raf.

To the description on page 23 add the following:

Head broad, depressed; snout short and rounded, nostrils midway between its tip and the front of the mouth; breadth of mouth greater than preoral length of snout. First dorsal very large, commencing close behind the base of the pectoral, its height a little greater than the length of its base, its anterior margin convex, its upper angle rounded, its posterior border nearly straight, its lower angle pointed, its height about equal to greatest depth of body; second dorsal much smaller than first; pectorals at least twice as long as broad; upper lobe of caudal one-fourth the total length, twice the inferior lobe. Grayish, fins rarely darker at tip. Coasts of Europe, etc. The claim of this species to a place in our fauna is extremely questionable.

(?*Carcharias lamia* Rafinesque, Indice d'Ittiol. Sicil. 1810, 44, no descr.: *Carcharias vulgaris* Cuvier, Règne Anim. ii, 126, 1817: *Carcharias lamia* Risso, Hist. Nat. Eur. Mer. iii, 119, 1826: *Squalis carcharias* of some early authors, not of Linnæus, whose account is based chiefly on *Carcharodon.*)

27 (*c*). **C. lamiella** Jor. & Gilb.

The species described as *E. lamia* on page 60 is probably distinct from the European species, and has been described by us (Proc. U. S. Nat. Mus. 1882) as *Carcharias lamiella.* In this description, on page 61, tenth line, for *height* read *size.* In the thirteenth line, read "in *not* having the first dorsal higher", etc.

Page 24. Instead of *Aprionodon punctatus* read:

29. A. isodon (Müll. & Henle) Gill.

It is doubtful whether this species has ever been taken on our coasts. The name *punctatus* is very doubtfully applied to this species, as the *Squalus punctatus* of Mitchill is as likely to have been *C. terræ-novæ*. *A. isodon* should be suppressed from our lists until its alleged occurrence in our waters is verified.

On page 25, the genus *Reniceps* is probably unworthy of retention, and it should be reunited to *Sphyrna*. The characters to be assigned to the genus *Sphyrna* are included under the account of the family. Species 31 should be—

S. tiburo (L.) Raf.

The correct reference to the description of *Sphyrna* is—

(Rafinesque, Indice d'Ittiol. Sicil. 1810, 46.)

On page 27, family X should be *Odontaspididæ*. Its single genus may stand as—

25.—ODONTASPIS Agassiz.

(Agassiz, Poissons Fossiles, iii, 87, 1836: type *Squalus ferox* Risso.)

The American species should stand as—

34. O. littoralis (Mitch.) J. & G.

The prior name *americanus* (Mitch.) was the result of an error of identification.

Page 28. Instead of *Isurus glaucus* read:

35. I. dekayi (Gill) J. & G.

Dark bluish-gray above, white below, the color abruptly changing on the tail; upper fins dusky, lower pale. Head 5 in length to tip of caudal; pectoral as long as head, a little longer than upper caudal lobe. Dorsals and pectorals falcate; first dorsal inserted behind pectoral at a distance equal to one-fourth head; base of dorsal $2\frac{1}{3}$ in head, its height $1\frac{3}{4}$. Middle teeth very long, much longer and narrower than lateral teeth. Length 10 feet. Cape Cod to West Indies. The American species seems to differ from the Asiatic *I. glaucus* in its longer pectorals and higher dorsal.

(*Lamna punctata* Dekay, New York Fauna, Fishes, 1842, 352 (not *Squalus punctatus* Mitch.): *Isuropsis dekayi* Gill, Am. Lyc. N. Y. 1858, 153: *Isuropsis glaucus* Poey, Synops. Pisc. Cubens, not *Oxyrhina glauca M. & H.* ?)

Page 29. Instead of *Isurus oxyrhynchus* read:

36. I. spallanzanii Raf.

This species should be erased, as there is no evidence of its occurrence

in our waters. "*Lamna punctata*" Storer is doubtless based on *Lamna cornubica*, with which species Rafinesque's description of *Isurus oxyrhynchus* is identified by Doderlein. This species should probably stand as *I. spallanzanii* Raf. (Indice d'Ittiol. Sicil. 45, 1810).

Page 30. The reference to the generic description of *Carcharodon* should be—

(Smith MSS.; Bonaparte, Mem. Soc. Neufch. ii, 9, 1839: type *Carchardon smithii* Bon. = *C. carcharias.*)

Page 30. Instead of *C. rondeletii* read:

38. C. carcharias (L.) J. & G.

To its synonymy add:

(*Squalus carcharias* L. Syst. Nat. i, 400, *excl. syn. pars: Carcharias verus* Agassiz, Poiss. Foss. iii, 91, 1836.)

Page 31. The reference to *Cetorhinus* should be—

("Blainville, Bull. Soc. Philom. 1816, 121.")

No. 39 should be—

39. C. maximus (Gunner) Blainv.

and to the synonymy should be added:

(*Squalus maximus* Gunner, Trondj. Selskschr. iii, 33, 1765.)

Page 31. The family *Rhinodontidæ* and its species, *Micristodus punctatus*, should be omitted, as they do not belong within our faunal limits.

Page 32. Instead of 31, *Gyropleurodus*, read:

31.—HETERODONTUS Blainville.

(Blainville, Nouv. Bull. Scienc. 1816, 121: type *Squalus phillipi* Lac.)

The characters of the genus are equivalent to those of the family. The American species should stand as—

41. H. francisci (Grd.) Gill.

It is abundant on the coast of California from Point Concepcion southward.

On page 37, instead of *Pristis antiquorum*, read:

44. P. pectinatus Latham.

And read in the description, "rostral teeth in 25 to 28 pairs" (instead of 16 to 20, the number found in *P. antiquorum;* we find no authentic record of the occurrence of the latter species in our waters). *P. pectinatus* occurs in the Tropical Seas, north to our South Atlantic coast; abundant in the Gulf of Mexico; ascending the Lower Mississippi.

(Latham, Trans. Linn. Soc. ii, 298, 1794; Günther. viii, 437.)

On page 37. The *Rhinobatidæ* are all ovoviviparous, a character which distinguishes them from the oviparous *Raiidæ*.

On page 38. *Rhinobatus leucorhynchus* Günther is not identical with *R. productus*, and should be erased from the synonymy of the latter species, which does not extend southward from California. In *R. productus* the rostral ridges are armed with small spines above, and are largely confluent anteriorly, not "separated along their entire length," as stated in the text; anterior nasal valve not dilated laterally and not extending to the inner edge of the nostril; first dorsal well behind tips of ventrals, not reaching nearly to the second. Females with a small digitate flap, free behind, above tip of snout. Color grayish, without pale spots; snout paler, a black blotch beneath it. San Francisco to San Diego. The description quoted in the text, from Dr. Streets, was taken from a specimen of *R. leucorhynchus*. *R. productus* and *R. lentiginosus* belong to the subgenus *Rhinobatus*, distinguished from "*Syrrhina*" by the long, sharp snout and narrow nasal flaps. Our two species of "*Syrrhina*" have each recently been made the types of new generic names, viz: "*Zapteryx*" (Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 53: type *Platyrhina exasperata* J. & G.) and "*Platyrhinoidis*" (Garman, Proc. U. S. Nat. Mus. 1880, 522: type *Platyrhina triseriata* J. & G.). *Platyrhinoidis* is "distinguished from *Syrrhina* and *Tryonorhina* by the labial fold, nasal valves, and marginal series of spines, and from *Platyrhina* by the fold, valves, separation of pectorals, and viviparity." *Trygonorhina alveata* Garman, Bull. Mus. Comp. Zool. 1880, 169, is identical with *Rhinobatus exasperatus*.

In *R. exasperatus* the dorsals are well forward, the origin of first dorsal being nearer hinder part of root of ventrals than front of second dorsal. In *R. triseriatus* the origin of first dorsal is nearer root of caudal than the hinder part of root of ventrals. In the latter the rostral ridges are strongly convergent, in *R. exasperatus* they are parallel.

On page 39, add to description of 47, *Torpedo californica* Ayres:

Color very dark brown, with small round black spots, which are sometimes obsolete. Eyes small, the spiracles at a distance behind them more than twice diameter of eye and more than length of spiracle; edges of spiracles not fringed; breadth of mouth about equal to its distance from tip of snout. Teeth small, sharp, in few series. Tail a little shorter than disk. First dorsal fin more than twice as large as second; half of it opposed to the ventrals. Coast of California; thus far seen only about San Francisco and Santa Cruz.

On page 39, after description of *Torpedo californica*, add:

36 (*b*).—**NARCINE** Henle.

(Henle, Ueber Narcine, 31: type *Torpedo brasiliensis* Olfers.)

Disk more or less rounded, not emarginate in front; spiracles extremely close to the eyes, their edges tuberculate or smooth; mouth narrow, surrounded by a circular fold of skin, which forms the frenum of the nasal valve; teeth in quincunx, not occupying the whole of the jaw, following the edge of the jaw outward, so that most of them are visible when the mouth is closed. Tail about as long as disk. Second dorsal larger than first. Tropical Seas. (νάρκη, numbness, an ancient name of the Torpedo.)

47 (*b*). **N. brasiliensis** (Olfers) Henle.

Subsp. **corallina** Garman.

Orange; a dark brown band across the head in front of the eyes, interrupted on the forehead; a large triangular space of the light color on the snout in front of the dark band; rest of body with faint dark markings and small round spots. Posterior borders of dorsals and caudal truncate; otherwise as in *N. brasiliensis* (Olfers) Henle, of which species this is thought to be a local variety. (*Garman.*) *N. brasiliensis* has the disk oval; the first dorsal smaller than the second; the teeth pointed and the spiracles very close to the eye, surrounded by a ring of small tubercles. Pensacola, Florida, to Brazil.

(*Torpedo brasiliensis* Olfers, Torped. 19: Günther, viii, 453; Garman, Bull. Mus. Comp. Zool. xi, 234, 1881.)

On page 42, after *Raia granulata*, add:

53 (*b*). **R. ornata** Garman.

Allied to *R. eglanteria*. Light brownish, freckled with paler, marked with a few groups of small darker spots; several spots on the tail; one at base of each dorsal. Disk little broader than long, the anterior margins convex; tip of snout obtuse; snout not produced; rostral cartilage obtuse. Width of mouth three-fourths its distance from end of snout. Teeth in upper jaw in 44 series. A median series of spines on back and tail; a lateral series on each side of this on back, and two on tail; a series on each orbital ridge; a single spine on forehead between eyes; several above tip of snout; a group on hinder angle of pectoral and on its anterior extremity; besides these the entire upper surface is rough with small asperities; lower surface smooth. Tail a little longer than disk. Deep water; off the coasts of South Carolina and Florida. (*Gar-*

man.) Perhaps a local variety of *R. ackleyi* Garman, a species described from Yucatan Banks.

(Garman, Bull. Mus. Comp. Zool. xi, 235, 1881.)

53 (*c*). **R. plutonia** Garman.

Brown, the adults purplish, with irregular transverse series of ill-defined, often confluent brown spots, besides some white spots; tail with light and dark bands; dorsals dark; lower surface white. Disk broader than long, subquadrangular, rounded in front; snout forming a very blunt angle; tail half longer than disk; rostral cartilage short, not extending to the tip of the snout. Width of mouth half its distance from snout. Teeth in 32 series. Eyes large, their length more than interorbital width. Back and tail covered with small, close-set, stellate spines, the points slender, compressed, directed backwards. A close series of large spines along the middle line of back and tail; a supraorbital row, and a single spine on each side of back of head; a series of about five on each side of shoulder-girdle, in front of which are one or two more; two series on each side of tail. Lower parts smooth. Deep water; off coast of South Carolina. (*Garman.*)

(Garman, Bull. Mus. Comp. Zool. xi, 236, 1881.)

On page 42, instead of *Raia cooperi*, read:

54. R. binoculata Grd.

The synonymy given to "*R. binoculata*" on page 44 should be transferred to this species, the original "*binoculata*" being the young, and "*cooperi*" the adult, of the same species.

On page 43, instead of *Raia binoculata*, read:

56. R. inornata Jordan & Gilbert.

For the synonymy given on page 44 substitute the following:

(*Raia inornata* Jor. & Gilb. Proc. U. S. Nat. Mus. 1880, 457 and 1881, 74.)

Var. *inermis* is also described in *loc. cit.* 1881, 74.

On page 45, after *Raia stellulata*, add:

57 (*b*). **R. parmifera** Bean.

Olive brown above, with numerous faint light blotches, two of which are larger than the rest. Disk considerably broader than long; tip of snout slightly projecting; interorbital width 3½ in distance from snout to eye; tail as long as distance from its root to eye. Teeth in 27 rows. Snout, supraoccipital region, and whole margin of pectorals and ventrals, covered with small prickles, as is also an area on tail; back and

tail with a median row of 22 to 29 large spines; tail with a marginal row of large spines; rest of disk mostly smooth. Lower surface smooth, except an elliptical area below tip of snout. L. 3 feet. Unalashka, Alaska. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. iv, 157, 1881.)

On pages 47 and 65, instead of "*Dasyatis* Rafinesque" or "*Dasibatis* Walbaum," read:

40.—TRYGON Adanson.

(Adanson MSS.; Geoffroy St. Hilaire, Descr. Egypte Poiss. 1809, 219: type *Trygon lymma* St. Hil. = *Raia pastinaca* L.)

The name *Trygon* seems to be prior to *Dasyatis* Raf. (1810); the earlier *Dasybatus* of Walbaum included all the rays, and is therefore properly a synonym of *Raia* L. The name *Trygon* is from τρυγών, a turtle-dove. "*Ab alarum expansarum similitudine. Sunt qui columbam marinam appellant*" (Rondelet, de Piscibus, 332, 1554).

The North American species of *Trygon* should stand as follows:

61. T. centrura (Mitch.) Linsley.

61 (*b*). **T. hastata** (Dekay) Storer.

62. T. sayi (Le Sueur) M. & H.

The specimen described on page 48 as "*Dasyatis sayi*" is the young of *T. sabina.*

63. T. dipterura Jor. & Gilb.

64. T. tuberculata (Lac.) Dum.

65. T. sabina Le S.

Page 50. Instead of *Aëtobatis* read:

41.—STOASODON Cantor.

(*Aëtobatis* Müller & Henle, Plagiostomen, 1841, 179: not of Blainville, Bull. Soc. Philom. 1816, 112 (= *Myliobatis*): *Stoasodon* Cantor, Catalogue Malayan Fishes, 1850, 1416: type *Raia narinari* Euphr.)

As the type of *Aëtobatis* Blainv. was *Raia aquila* L., the use of the same name for a different genus is not allowable. (στοᾶς, arch; ὀδοὺς, tooth.) Our species should stand as—

66. S. narinari (Euphrasen) Cantor.

Stoasodon laticeps (Gill) J. & G. (*Aëtobatis laticeps* Gill, Ann. Lyc. Nat. Hist. N. Y. 1865, 137 = *Aëtobatis latirostris* Günther, Fish. Centr.

Amer. 1869, 491), described from a specimen sent from San Francisco, should probably not be included in this work. The species is abundant on the west coast of Mexico, from which region the typical specimen was most likely obtained.

Page 50. An earlier reference to *Myliobatis* is—

(Duméril MSS.; Geoffr. St. Hilaire, Descr. Poiss. Egypte, 1809, 336.)

Page 53. To synonymy of "*Manta birostris*" add:

(*Raia birostris* Walbaum, Artedi Pisc. 1792, 535.)

On page 77, last line, and page 78, forty-fourth line, for *Pristipomatidæ*, 87, read: SPARIDÆ, 88.

On page 78, seventh line, for *Teuthydidæ*, read: ACANTHURIDÆ, 99.

On page 78, thirtieth line, for *Trachinidæ*, read: LATILIDÆ, 102.

On page 78, nineteenth line, for *Centrarchidæ*, 84, read: ELASSOMATIDÆ, 83 (*b*).

On page 79, seventeenth and twenty-ninth lines, for *Triglidæ*, 108, read: AGONIDÆ, 108 (*a*).

On page 80, twenty-first line, for *Trachinidæ*, read: TRICHODONTIDÆ, 102 (*b*.)

On page 80, thirty-fourth line, for "B," read "A A."

On page 81, after YYY, add:

YYYY. Dorsal fin single, the anterior half spinous, the posterior soft.

BLENNIIDÆ, 112.

Page 92. The group here called *Litholepis* is to be considered as a section of *Lepidosteus* rather than as a distinct genus. The name *Atractosteus* (Raf. Ichth. Oh. 1820, 73) should probably be adopted instead of *Litholepis*. The name *Litholepis adamantinus* was given to a drawing by Mr. Audubon. A copy of this drawing was preserved by Rafinesque in his field-note book, which we have examined. It is evidently a fancy sketch, like the "*Pogostoma*," "*Aplocentrus*," "*Eurystomus*," and other ichthyological myths, which the humorous artist imposed on the credulous naturalist. *Esox viridis* L. was undoubtedly intended for *Lepidosteus osseus*.

Page 101. Instead of *Pilodictis* read:

53.—LEPTOPS Rafinesque.

(Rafinesque, Ichth. Oh. 1820, 64: type *Pimelodus viscosus* Raf. = *Silurus olivaris* Raf.
λεπτός, small; ὠψ, eye.)

The species should stand as—

91. L. olivaris (Raf.) J. & G.

"*Pilodictis limosus*" Raf. was likewise based on a "drawing by Mr. Audubon," which drawing, as shown by Rafinesque's copy, is merely a fancy sketch of an imaginary cat-fish. The name should therefore be disregarded. Of the remaining synonyms of this type, *Leptops* stands next in date.

On page 105, after *Amiurus catus*, add:

98 (*b*). **A. brachyacanthus** Cope.

Blackish, yellowish below. Body robust. Head not depressed; eye small, 7 in head, 4 in interorbital width. Maxillary barbels reaching middle of pectoral spine; mental barbels to beyond the branchiostegals; jaws equal. Dorsal and pectoral spines small, acute, not concealed in the skin, equal in length, less than the interorbital width, and not one-third distance from snout to dorsal; pectoral spine weakly serrate behind only; caudal not described. Head $3\frac{3}{5}$; depth $4\frac{2}{5}$. D. I, 6; A. 22; P. I, 6. Medina River, Texas. (*Cope.*)

(Cope, Bull. U. S. Nat. Mus. xx, 35, 1880.)

On page 105, after *Amiurus natalis*, add:

100 (*b*). **A. bolli** Cope.

Olivaceous, belly and lower barbels pale. Body very slender. Head flat, one-fifth longer than wide; jaws subequal; base of anal as long as head. Pectoral spine finely serrate posteriorly, more than half length of head; dorsal spine long, smooth, a little shorter than pectoral, its base a little nearer muzzle than adipose fin; longest anal rays half head; caudal rounded, its upper rays longer than lower. Head $3\frac{2}{3}$; depth $5\frac{1}{4}$. A. 25. Little Wichita River, Texas. (*Cope.*) Perhaps a variety of *A. natalis*.

(Cope, Bull. U. S. Nat. Mus. xx, 35, 1880.)

Page 106. The genus *Ictalurus* has been heretofore usually distinguished from *Amiurus* by the connection of the supraoccipital process with the second interspinal. In all the species with truncate or rounded caudal fin, there is a considerable interval between these bones. In the

fork-tailed species, commonly referred to *Amiurus*, the two bones are more or less close together; in some species apparently joined in the young, but separated in the adult; in others apparently slightly separated at the surface and joined under the skin. In but two species, *furcatus* and *punctatus*, is there a continuous bridge formed at all ages. In view of the complete intergradation of this character, we have retained the name *Amiurus* for the species with truncate caudal and the interspinal and supraoccipital wholly separate, and *Ictalurus* for those with forked caudal and the two bones in question joined or approximated. The only other alternative, and a not unreasonable one, is to refer all these species to one genus, *Ictalurus*.

On page 108, instead of *Ictalurus lacustris*, read:

106. I. nigricans (Le S.) Jor.

The "*Gadus lacustris*"* (Walb. Artedi, Pisc. 1792, 144) can hardly be identified with any fish.

Page 110. To the description of *Arius felis*, the following may be added:

Bands of palatine teeth large, not prolonged backward over the pterygoid region; fontanelle prolonged backward in a narrow groove; occipital process long, narrow, keeled. Pectoral rays I, 9.

Arius equestris B. & G., is not distinct from *A. felis*, and should be erased.

Page 111. Instead of *Plectospondyli* read Order L. EVENTOGNATHI. The latter name is unobjectionable, and has priority of date.

Page 113. We do not believe that *Ictiobus*, *Bubalichthys*, and *Carpiodes* can be maintained as distinct genera, and think it preferable to unite the three under the earliest name, *Ictiobus*. In its dentition, *Ictiobus* is intermediate between *Carpiodes* and *Bubalichthys*, and in structure of mouth *Bubalichthys* stands between the others.

We have examined the original manuscript note-book of Rafinesque, containing the descriptions which were afterwards printed in the Ichthyologia Ohiensis. In this book is a drawing of his "*Ictiobus bubalus*,"

* It is described as follows:

"*Gadus lacustris*, Americanis Mathemeg, Anglis *Land Cod*, Pennant, Arct. Zool. Introd. p. 191. Corpus tripedale, superne sub spadiceum, inferne griseum; cirri tres in mandibula inferiore, quorum medius longitudine duos alios vincit."

The "Mathemeg or Land Cod" of Pennant is said by Richardson to be a cat-fish, and it may have been *I. nigricans*, but the description is wholly insufficient.

from which it is evident that the species intended was the *Catostomus bubalus* of Kirtland—the *Bubalichthys altus* of this work (p. 116). If this identification be accepted in our nomenclature, the specific name *bubalus* should take the place of *altus*, and *cyprinella* that of *bubalus*. If Rafinesque's species be considered unidentifiable, the same change should be made, as Kirtland's use of the name *bubalus* followed next. As Rafinesque's *I. bubalus* was the type of his *Ictiobus*, in strictness the name *Bubalichthys* should be superseded by *Ictiobus* as a subgeneric name, while the group heretofore called *Ictiobus* would be called *Sclerognathus* C. & V.

In this view, the species should stand as follows:

113. I. cyprinella (C. & V.) Ag. (*Sclerognathus.*)

114. I. urus (Ag.) J. & G. (*Ictiobus.*)

115. I. bubalus Raf. (*Ictiobus.*)

116. I. carpio (Raf.) Nels. (*Carpiodes.*)

117. I. damalis* (Grd.) J. & G. (*Carpiodes.*)

118. I. thompsoni (Ag.) Nels. (*Carpiodes.*)

119. I. bison (Ag.) Nels. (*Carpiodes.*)

120. I. cyprinus (Le S.) J. & G. (*Carpiodes.*)

121. I. difformis (Cope) Nels. (*Carpiodes.*)

Of these species, 117, 118, 119, and 121 are of doubtful validity.

Page 126. The following species of *Catostomus* may be added:

130 (*c*). **C. nebulifer** Garman.

Brownish, clouded and blotched with darker; a blackish lateral shade; belly pale; lower half of preopercle abruptly silvery. Body stout, little compressed. Head nearly as broad as eye; eye small, about half snout; mouth small; lips with considerable free margin. Dorsal inserted midway between snout and caudal; caudal deeply notched; anterior rays of dorsal longest. Head 5; depth 5. D. 9; A. 8; scales 14–90–14. Nazas River, Coahuila. (*Garman.*) Very close to *C. guzmaniensis*, if not the same.

(*Catostomus nebuliferus* Garman, Bull. Mus. Comp. Zoöl. viii, 89, 1881.)

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* It is better not to adopt the name *tumidus* for any species of *Carpiodes*, as the original *Carpiodes tumidus* is not certainly identified. The description agrees well with young specimens of *I. bubalus*, a species lately obtained by us in Texas.

Page 145. "Teeth one-rowed (*Chondrostominæ*)" belongs after ‡, not ††.

Page 148, thirtieth line, instead of *Alburnus*, read: RICHARDSONIUS, 108.

Page 156. *Hyborhynchus flavipinnis* is described by Professor Cope in Bull. U. S. Nat. Mus. xx, 36, 1881, and *H. nigrotæniatus* and *Cochlognathus biguttatus*, on page 37 of the same paper.

Page 157. After *H. fluviatilis* add:

188 (*b*). **H. punctifer** Garman.

Brownish, paler below; cheeks silvery; scales punctulate; a black spot at base of caudal. Body little compressed, the anterior profile regularly curved. Head moderately broad; snout rounded, little longer than eye; mouth small; maxillary reaching half way to eye. Ventrals short, not reaching vent, inserted a little in advance of dorsal. Pectorals short, reaching little more than half way to ventrals; caudal deeply notched. Lateral line slightly decurved. Head 4; depth 4. D. 8; A. 8; scales 5–40–3. "Distinguished from *D. couchii* Grd. by the size of the scales and a stouter form." Tributaries of Lago del Muerte, Coahuila. (*Garman.*)

(*Hybognathus* (*Dionda*) *punctifer* Garman, Bull. Mus. Comp. Zoöl. viii, 89, 1881.)

Page 176. After *C. bubalina* add:

236 (*b*). **C. rubripinna** (Garm.) J. & G.

Brownish above, sides rosy or silvery; cheeks silvery; a brownish band from nape to pectorals; lower fins salmon color; caudal reddish; dorsal dark brown. Body deep, much compressed, the back arched. Head small; snout shorter than eye; maxillary not reaching eye. Pectorals not reaching ventrals, the latter to anal; caudal deeply forked. Scales much deeper than long. Head $4\frac{1}{2}$; depth $2\frac{2}{3}$. D. 8; A. 11; scales 7–38–3. L. 3 inches. Tributaries of Lago del Muerte, Coahuila. (*Garman.*)

(*Cyprinella rubripinna* Garman, Bull. Mus. Comp. Zoöl. viii, 91, 1881.)

Page 206. *Rhinichthys* Ag.:

Professor Garman gives in Science Observer (1881, vol. iii, No. 8, p. 57) a detailed account of the genus *Rhinichthys*, in which 15 species

are recognized. These are distinguished by the characters given in the following analytical key:

a. Mouth inferior, snout produced beyond it.
b. First dorsal ray midway between end of snout and base of caudal.
c. Lateral line 60–64; l. trans. 10 + 1 + 9 ..... *nasutus.*
cc. Lateral line 70 ..... *cataractæ.*
bb. First dorsal ray midway between anterior nostril and base of caudal.
d. Lat. l. 75–80; l. trans. 10 + 1 + 10 ..... *marmoratus.*
dd. Lat. l. 70; l. trans. 10 + 1 + 10 ..... *luteus.*
bbb. First dorsal ray midway between front of mouth and base of caudal.
e. Lat. l. 70; l. trans. 11 + 1 + 10; snout narrow ..... *ocella.*
ee. Lat. l. 80; l. trans. 12 + 1 + 12 ..... *dulcis.*
eee. Lat. l. 70–72; l. trans. 12 + 1 + 13 ..... *transmontanus.*
bbbb. First dorsal midway between middle of eye and base of caudal.
f. L. trans. 25 ..... *maxillosus.*
aa. Mouth subinferior, snout not produced.
g. First dorsal midway between nostril and base of caudal; lat. l. 80; l. trans. 14 + 1 + 10 ..... *badius.*
gg. First dorsal midway from eye.
h. Lat. l. 58–60; l. trans. 9 + 1 + 7 ..... *simus.*
hh. Lat. l. 70; l. trans. 11 + 1 + 8 ..... *obtusus.*
hhh. Lat. l. 63; l. trans. 12 + 1 + 9 ..... *atronasus.*
i. Stout, black band obsolete ..... *lunatus.*
aaa. Mouth anterior.
k. First dorsal midway from front of eye.
l. Lat. l. 69–76; l. trans. 11 + 1 + 10 ..... *meleagris.*
ll. Lat. l. 64; l. trans. 9 + 1 + 7 ..... *arenatus.*

Most of these species we are unable to recognize. They seem to us to be merely local varieties, or even individual variations, of the two or three most widely-distributed types in this genus.

The following may perhaps be inserted:

Page 207. After *R. transmontanus* add:

316 (*b*). **R. dulcis** (Grd.) Jor. & Copel.

Reddish brown, clouded with darker; lateral band very faint; a dark caudal spot. Snout blunt, projecting beyond mouth, which is small and inferior. Barbel small, sometimes absent. Ventrals reaching vent. Scales small. Head $4\frac{1}{4}$. D. 9; A. 8; scales 12–80–12. Platte Valley. (*Garman.*)

(*Argyreus dulcis* Grd. Proc. Acad. Nat. Sci. Phila. 1856, Sweetwater River; Garman, Science Observer, 1881, 59, Cheyenne: *Rhinichthys ocella* Garman, l. c. 59, from N. E. Wyoming and Montana, has the snout narrow, the barbel conspicuous, the scales 11–70–10: *Rhinichthys luteus* Garman, Bull. Mus. Comp. Zoöl. 1881, 87, and Science Observer, 1881, 59, from Ogden, Utah, has the snout long, more than twice eye, the barbel small, and the scales 10–70–10: *Rhinichthys marmoratus* Ag.; Garman, l. c. 58, from Sault Ste. Marie, has the scales 10–78–10, and is possibly distinct from *R. cataractæ.*)

Page 208. After *Rhinichthys atronasus* add:

318 (*b*). **R. badius** Garman.

Brownish, mottled; sides and belly silvery. Front of dorsal midway between nostril and eye. Scales 14–80–10; otherwise as in *R. obtusus*. Clinch River. (*Garman.*)

(Garman, Science Observer, 1881, 60.)

318 (*c*). **R. simus** Garman.

Clouded brown; a dark lateral stripe, bounded above by a silvery line. Head depressed above and in front of eyes; snout rather broad, thin, little projecting. First dorsal midway between eye and base of caudal. Head $4\frac{1}{4}$. D. 9; A. 8; scales 9–60–7; teeth 2, 4–4, 2. Coahuila, Mexico. (*Garman.*)

(Garman, Science Observer, 1881, 61.)

318 (*d*). **R. meleagris** Ag.

Similar to *R. obtusus*, but with the jaws nearly equal. Head broad, narrowed anteriorly; lips small; teeth 2, 4–4, 2. Head $3\frac{4}{5}$. D. 9; A. 7; scales 11–70–8. Western Illinois and Iowa.

(Agassiz, Am. Journ. Sci. Arts, 1854, 357; Garman, Bull. Mus. Comp. Zoöl. 1881, 86, and Science Observer, 1881, 62.)

318 (*e*). **R. arenatus** Garman.

Similar to *R. meleagris*, but with larger scales, and the teeth 1, 4–4, 1. Head $4\frac{1}{4}$; depth $5\frac{1}{2}$, D. 8; A. 7; scales 9–64–7. Sand Hill River, Minnesota. (*Garman.*)

(Garman, Bull. Mus. Comp. Zoöl. 1881, 87, and Science Observer, 1881, 62.)

Page 235, tenth line, read: "nearly reaching *ventrals*."

Page 241. The specimens described in the text as *Squalius atrarius*, are the young of the species described on page 240 as *Squalius rhomaleus*. *Siboma atraria* Cope is also identical with the latter species. Whether *Siboma atraria* Grd. is the same is very doubtful. The following are the characters assigned to it, and may be substituted for those given in the text:

397. S. atrarius (Grd.) J. & G.

Blackish above, mottled with dark; paler below. Body somewhat elongate, subfusiform; caudal peduncle stout; head larger than in *S. gibbosus;* the fins lower; profile of head gently sloping forward, the snout subconical. Mouth small, the maxillary not reaching to opposite eye. Eye small, $5\frac{1}{2}$ in head. Dorsal inserted over ventrals, nearer

base of caudal than snout. Head nearly 4 (with caudal). D. 9; A. 8; scales 11–7. Teeth 1, 4–5, 2, without grinding surface properly so called. L. 7 inches. From a spring in Utah, near the desert. (*Girard.*)

(*Siboma atraria* Grd. Proc. Ac. Nat. Sci. Phila. 1856, 208, and U. S. Pac. R. R. Surv. x, 297: ?*Siboma atraria* var. *longiceps* Cope & Yarrow, Zoöl. Wheeler's Expl. W.100th Mer. v. 667, 1876, from Nevada; a small fish with the scales 12–56–5, the head 4, the depth 4¼ in length.)

Page 244. Numerous specimens of *Phoximus phlegethontis* from Provo River examined by us are full-grown at a length of barely 2 inches; the lateral line is almost wholly wanting in all.

Page 244. If the generic name *Leucos* be considered as preoccupied, this genus should stand as—

104.—MYLOLEUCUS Cope.

Page 262. Instead of *Megalops thrissoides* read:

436. M. atlanticus C. & V.

And erase the synonym "*Clupea thrissoides* Bloch & Schneider, 1801, 424," inserting instead "*Megalops atlanticus* C. & V. xix, 398."

Clupea thrissoides Bloch & Schneider is based on Broussonet's description of his *Clupea cyprinoides*, which is the East Indian *Megalops cyprinoides* (Brouss.) Bleek. On our Gulf coast, *Megalops atlanticus* reaches a length of about 6 feet, and is known as "Grande Ecaille."

Page 265. After *Clupea sagax* add:

441 (*b*). **C. pseudohispanica** (Poey) Gthr.—*Spanish Sardine.*

Plain bluish, silvery or golden below. Body slender, little compressed, the belly scarcely carinated, its scutes weak; mouth small, the maxillary extending a little past front of pupil, $2\frac{3}{5}$ in head; lower jaw and tongue with a few feeble teeth; cheeks much longer than deep, the depth below eye $\frac{3}{4}$ eye, which is $3\frac{1}{2}$ in head; opercle without striæ. Gill-rakers long, very slender, 30 to 40 below angle. Caudal as long as head; ventrals below middle of dorsal; peritoneum pale. Head $4\frac{1}{4}$; depth $5\frac{1}{4}$. D. 18; A. 17; Lat. l. about 45. L. $6\frac{1}{2}$ inches. Cuba to Pensacola, Florida. Closely allied to the European Sardine (*Clupea pilchardus* Walbaum), which is best distinguished by the strongly striate opercle.

(*Sardinia pseudohispanica* Poey, Memorias Cuba, ii, 311, 1860; Günther, vii, 442.)

Page 271. After *D. cepedianum* add:

451. D. mexicanum (Gthr.) J. & G.

Silvery, a small round dark spot at the shoulder. Maxillary reaching front of eye; jaws even in front; eye as long as snout, four in head

Insertion of dorsal fin median, immediately behind base of ventrals; the filament reaching end of anal fin. Scales large; nine scutes behind ventrals. Head $3\frac{1}{5}$; depth $2\frac{3}{4}$. D. 14; A. 25; Lat. l. 40; L. tr. 13. Gulf of Mexico; north to Louisiana. (*Günther.*)

(*Chatoëssus mexicanus* Günther, vii, 409, 1868.)

Page 273. After *Stolephorus ringens* add:

452 (*b*). **S. nanus** (Grd.) J. & G.

Pale, but not translucent; sides with a broad silvery shade, but without distinct stripe. Body slender, moderately compressed, the belly carinate and faintly serrate. Head compressed, conic, the snout rather pointed, bluntish at tip. Maxillary extending beyond root of mandible. Eye not very large. Teeth in both jaws. Pectorals and ventrals short. Head $3\frac{1}{2}$; depth 5. A. 22. Southern California; abundant. Very likely the young of *S. ringens*, from which it seems to be separated by the more compressed body. The many specimens obtained by us at San Diego were of the same size, and schools of immature anchovies, uniform in size, are rarely seen.

(*Engraulis nanus* Girard, U. S. Pac. R. R. Surv. x, 334, 1858.)

Page 273. After *Stolephorus hiulcus*, which is probably identical with *S. browni*, read;

454 (*b*). **S. mitchilli** (C. & V.) J. & G.

Very pale, translucent, the silvery lateral stripe very narrow and not well defined, scarcely wider than pupil; snout and caudal yellowish, with many dark points; middle line of back with a continuous stripe formed of dark points; dark points along base of anal and behind it. Body rather short and deep, compressed, belly slightly serrated; snout short, not longer than pupil; eye very large; maxillary extending beyond root of mandible, about to margin of opercle; both jaws with distinct teeth; cheeks broadly triangular. Anal long and high, its base $3\frac{2}{5}$ in body; its first ray nearly under middle of dorsal. Pectorals long, $1\frac{1}{4}$ in head. Head $3\frac{4}{5}$; depth 4. D. 14; A. 26; Lat. l. about 37. L. $2\frac{1}{2}$ inches. Atlantic coast; abundant from Cape Cod to Southern Texas.

(*Engraulis mitchilli* Cuv. & Val. xxi, 50 (not of Günther): *Engraulis vittatus* Storer, Hist. Fish. Mass. 341, pl. xxvii, f. 3 (not *Clupea vittata* Mitch.); Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882: *?Engraulis duodecim* Cope, Trans. Am. Philos. Soc. 1866, 405 (last ray of dorsal said to be in front of first of anal).

On page 276, after *Alepidosaurus ferox*, add:

458 (*b*). **A. æsculapius** Bean.

Closely related to *A. ferox*, differing chiefly in the much shorter pec-

torals and ventrals, the latter of 7 rays, the former of 12. Gill-rakers 23 (27 in *A. ferox*). Eye 5 in head, the maxillary extending to beyond it. Head 6; depth 11. D. 39; A. 16; vertebræ (as in *A. ferox*) 50. Unalashka, Alaska. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. v, 1882.)

Page 281. After *Synodus lucioceps* add:

464 (*b*). **S. intermedius** (Spix) Poey.—*Sand-diver.*

Grayish, abruptly paler below; back and sides with eight dark cross-bands, broadest at lateral line; a jet-black blotch on upper part of shoulder-girdle, hidden by opercle; membrane of maxillary black; dorsal and pectorals barred, the former in fine pattern; lower fins and lower part of head sulphur yellow. Body rather stout; head blunt, large, the snout broader than long, about equal to eye, which is $4\frac{1}{2}$ in head; frontal bones little striate; interorbital space concave, 6 in head; prominent striæ behind eye; jaws subequal; maxillary $1\frac{2}{3}$ in head, longer than pectoral. Scales large, 4 to 6 rows on cheek; 3 series between adipose fin and lateral line. Dorsal high, as high as long; pectoral 2 in head; ventral $1\frac{1}{6}$. Head 4; depth 8. D. 11; A. 11; scales 4–48–7. L. 15 inches. West Florida to Brazil.

(*Saurus intermedius* Spix, Pisc. Brazil, 81: *Saurus intermedius* Günther, v, 396: *Saurus analis* Cuv. & Val. xxii, 483; Poey, Syn. Pisc. Cub. 414.)

On page 288, twelfth line, read: Mouth *generally* terminal.

On page 290, all the text between the description of *Microstoma grœnlandicum* and that of *Mallotus*, on page 291, should be cancelled.

On page 300, after *Coregonus merki*, add:

493 (*b*) **C. laurettæ** Bean.

"The height of the body is greater than the length of the head and equals one-fourth of the total length without the caudal; the distance of the nape from the front margin of the jaw is contained $2\frac{1}{2}$ times in its distance from the beginning of the dorsal. The diameter of the eye equals the length of the snout, and is about one-fifth that of the head. Maxillary reaching nearly to the middle of the eye, its length contained $3\frac{1}{2}$ times in that of the head; the supplemental bone about half as long as the maxilla, and its greatest width equals one-third of its length. The length of the mandible equals three-sevenths of that of the head, reaching to the hind margin of the orbit. The appendage of the ventral fin is less than half as long as the fin and nearly equal in length to the 7 scales immediately over it." Eye 5 in head. Scales much smaller

than usual in *C. artedi*. D. 12; A. 11; V. 12; P. 16; Lat. l. 84 to 95. Northern Alaska; Yukon River to Point Barrow. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. iv, 1881, 156.)

Page 306. Instead of *Oncorhynchus chouicha* read:

499. O. tchawytcha (Walb.) J. & G.

The barbarous appearance of this name scarcely warrants so great a change in its orthography.

Page 320. No. 515, *Salvelinus hoodii*, should be erased. The specimens in the British Museum, described by Dr. Günther as *Salmo hoodi* (vi, 150), belong to *Salvelinus namaycush*. The remaining types of Richardson's original description belong to *Salvelinus fontinalis*.

Page 325. After *Chologaster agassizi* add:

523 (*b*). **C. papillifer** Forbes.

The specimen from Southern Illinois, described in the text from the MSS. of Professor Forbes, proves to be distinct from *C. agassizi*. Several other specimens have been since obtained. It is further distinguished from the other members of the genus by the presence of tactile papillary ridges, as in *Amblyopsis* and *Typhlichthys*. The character of "no papillary ridges", assigned in the text to *Chologaster*, should therefore be erased.

(*Chologaster papilliferus* Forbes, Amer. Nat. Jan. 1882, 1.)

Page 329. *Cyprinodon gibbosus* appears to be identical with *C. variegatus*, differing possibly in slightly greater size and deeper coloration, the ante-dorsal region being, in the males, of an intense steel-blue and the lower parts largely salmon-red. Head $3\frac{2}{5}$ to $3\frac{3}{5}$; depth 2 to $2\frac{3}{5}$. D. 11; A. 10; scales 26–13.

For *Cyprinodon gibbosus* (B. & G.) substitute—

526. C. bovinus B. & G.

A doubtful species, differing from *C. variegatus* in having the head 3 in length, the eye 4 in head, the ventrals under anterior margin of dorsal, and the fin-rays D. 9, A. 8. Leon's Spring, Texas.

(B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 389, etc.)

526 (*b*). **C. eximius** Grd.

Differs from *C. variegatus* in having the head $3\frac{1}{3}$ in length, the eye 4 in head; D. 12, A. 12. Coloration pale, the male largely golden. L. $2\frac{1}{2}$ inches. Chihuahua River.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 158.)

Page 333. *Fundulus similis* is very abundant everywhere on the Gulf coast and north to South Carolina.

Page 333. Instead of *Fundulus zebra* read:

536. F. zebrinus J. & G. nom. sp. nov.

The name "*zebra*" is preoccupied in this genus.

Page 335. Omit from the synonymy of *Fundulus adinia*, *Adinia multifasciata* Grd. which is a very different species = *Fundulus xenicus* J. & G.

Page 336. After *F. nigrofasciatus* add:

542 (*b*). **F. ocellaris** J. & G.

♂ dark olive, golden below; sides with 13 to 15 dark cross-bands, nearly parallel, the anterior narrower than the interspaces; sides posteriorly finely speckled, with small pearly spots on both bands and interspaces; dorsal and anal margined with orange; both fins with black and pearly spots. ♀ dark olive; sides dusted with dark points; middle of sides with about 13 very narrow dark half bars; dorsal with an ocellated black spot posteriorly. Head small and slender, the snout short. Body rather slender. Eye 4 in head, $1\frac{2}{5}$ in interorbital width. Teeth small, the outer series somewhat enlarged. Dorsal high, in males reaching base of caudal, in females much lower; anal inserted under second ray of dorsal. Oviduct not adnate to its first ray. Head $3\frac{1}{4}$; depth 4. D. 11; A. 10; V. 6; P. 13; scales 35–15. L. 3 inches. Pensacola Bay, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

Page 336. After *Fundulus heteroclitus* add:

543 (*b*). **F. grandis** B. & G.

Very closely related to *F. heteroclitus*, but differing constantly in the much lower fins, the longest rays of the dorsal even in the male not more than half head, of anal $1\frac{3}{4}$ in head; eye 4 to $4\frac{1}{2}$ in head, slightly more than half interorbital space. Head 3 to $3\frac{1}{5}$; depth $3\frac{3}{5}$ to $3\frac{5}{6}$. D. 11; A. 10 or 11; scales 35 to 38–15. L. 3 to 6 inches. Gulf coast; replacing *F. heteroclitus*.

(B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 389, etc.: *Fundulus floridensis* Grd. Proc. Acad. Nat. Sci. Phila. 1859, 157.)

Page 337. After *Fundulus stellifer* add:

xx. Body short and deep, strongly compressed; gill-membranes restricted above to region below upper edge of pectoral. (*Adinia* Grd.)

545 (*b*). **F. xenicus** J. & G.

♂ dark green; sides with 10 to 14 narrow, pearly bands, slightly oblique, and mostly narrower than the interspaces; a diffuse dusky blotch below and behind eye; lower jaw orange; belly yellow; dorsal and anal blackish, with many round, pale-blue spots, besides orange spots near base of fin; caudal barred, with some pale spots; ventrals dusky, tipped with yellow. ♀ greenish, with a faint dark lateral shade and some pale cross-bands; lower fins largely yellow; upper mostly dusky. Body very deep, much compressed, much as in *Cyprinodon;* the caudal peduncle very deep; the head depressed, rapidly tapering to a sharp, conical snout; the anterior profile somewhat concave. Females and young with the back less elevated. Teeth very small, in a villiform band, those of the outer series wide-set and considerably larger. Eye large, 3 in head, $1\frac{1}{5}$ in interorbital space; opercle adnate to shoulder-girdle above base of pectoral (as in *Cyprinodon* and *Jordanella*). Dorsal inserted in advance of anal, its origin midway between caudal and middle of eye, the longest rays in males reaching base of caudal, $1\frac{2}{5}$ in head; anal lower; ventrals $1\frac{1}{2}$ in head. Intestinal canal as long as body. Head 3; depth 2 ($2\frac{2}{5}$ to $2\frac{4}{5}$ in ♀). D. 9 or 10; A. 11 or 12; V. 6; P. 14; B. 5; scales 25–10. L. 2 inches. Gulf coast, West Florida to Texas; locally very abundant in shallow lagoons.

(*Adinia multifasciata* Girard, Proc. Acad. Nat. Sci. Phila. 1859, 117; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, not *Hydrargyra multifasciata* Le Sueur, nor *Fundulus adinia* Jor. & Gilb.)

Page 340. *Zygonectes atrilatus* should probably be suppressed. It appears to be based on females of *Gambusia patruelis.*

Page 340. Instead of *Zygonectes melanops* read:

552. Z. imurus J. & G.

The known specimens of this species are from Cache River, in Southern Illinois. For the synonymy in the text substitute—

(*Zygonectes melanops* Jordan, Bull. Illinois Lab. Nat. Hist. ii, 52, 1878 (not *Haplochilus melanops* Cope): Jor. & Gilb. Proc. U. S. Nat. Mus. 1882: *Haplochilus melanops* Cope and *Z. melanops* Hay are apparently *Gambusia patruelis.*)

Page 341. *Zygonectes brachypterus* is described by Professor Cope in Bull. U. S. Nat. Mus. xx, 34, 1880.

Page 341. After *Zygonectes dispar* add:

553 (*b*). **Z. craticula** Goode & Bean.

Olivaceous; sides with about 6 sharply-defined, jet-black longitudinal

stripes following the rows of scales, the stripes a little narrower than the interspaces; a large blackish blotch below eye; fins nearly plain, the upper somewhat dusky; young with faint dark bars. Body comparatively long and slender, little compressed. Caudal peduncle long, rather slender. Head long, broad and depressed above. Eye large, about equal to snout, $\frac{2}{3}$ interorbital width, $3\frac{1}{4}$ in head. Lower jaw heavy. Teeth small, the outer scarcely enlarged. Fins all small. Head $3\frac{2}{3}$; depth 5. D. 8; A. 9; scales 40–10. Indian River, Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. v, 1882.)

Page 343. *Lucania venusta* is generally common along the Gulf coast. Color nearly plain light olive, the males with the dorsal and caudal bright yellow, the anal orange, each of these fins margined with black; dorsal with black spot at base in front, ocellated with yellow. D. 11 or 12; A. 9 or 10; scales 26–8.

Page 343. To the description of *Lucania parva* add:

Plain olive, edges of scales darker; front of dorsal with a dusky spot. Body comparatively deep, the back somewhat arched. Dorsal high; anal small. Head $3\frac{1}{3}$; depth $3\frac{1}{3}$. D. 11; A. 8; scales 26–8. L. $1\frac{1}{2}$ inches. Connecticut to Florida (*Bean*).

Page 345. No. 562 may be redescribed as follows:

562. G. patruelis (B. & G.) Grd.

Light olive, each scale edged with darker; a very narrow dark streak along sides; top of head dusky; an obscure bluish-black bar below eye; a black blotch on each side of belly, caused by the black peritoneum showing through the skin; fins dusky; the caudal sometimes dotted. Body rather slender. Head small, very broad and much depressed; teeth in broad villiform bands; eye small, $1\frac{3}{4}$ in interorbital width, $3\frac{1}{3}$ to $3\frac{1}{2}$ in head. Intestinal canal as long as body. Dorsal small, far back; distance from its insertion to caudal half that to snout; anal larger and higher than dorsal. Head 4; depth 3 to 4. D. 7; A. 8 or 9; scales 30–10. L. $1\frac{1}{2}$ inches. Marshes and lagoons of the South Atlantic and Gulf coasts, Delaware to Mexico, mostly in brackish or fresh water; excessively common in Louisiana. Eastern specimens (var. *holbrooki;* Maryland to Florida) have usually the eye larger, about one-third length of head, $1\frac{1}{2}$ in interorbital width; head $3\frac{2}{3}$ in length.

The young are produced in early summer, when about one-third of an inch long.*

(*Heterandria patruelis* B. & G. Proc. Acad. Nat. Sci. Phila. 1853, 390; Grd. U. S. Mex. Bound. Surv. Ichth. 72: *Gambusia speciosa, gracilis* Grd. Proc. Acad. Nat. Sci. Phila. 1859, 121: *Heterandria affinis* B. & G. l. c. 390: *Gambusia humilis* and *affinis* Gthr. vi, 335, 336: *Heterandria holbrooki* Agassiz MSS.; Girard, Proc. Acad. Nat. Sci. Phila. 1859, 61; Günther, vi, 334: *Haplochilus melanops* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 457: *Zygonectes atrilatus* Jor. & Brayt. Bull. U. S. Nat. Mus. xii, 84, 1878.)

Pages 345, 346. *Gambusia humilis* and *Gambusia affinis* may be suppressed as identical with *G. patruelis.*

Page 346. After *Gambusia nobilis* add:

566 (*b*). **G. semilis** Grd.

Brown, sides with dark specks; vertical fins speckled. Ventrals very small, not reaching vent; anal rather large. Head 5 in total length. D. 9; A. 10. L. $2\frac{1}{4}$ inches. Chihuahua River.

(Girard, Proc. Acad. Nat. Sci. Phila. 1859, 121.)

Page 347. Under *Mollienesia latipinna* read:

"Eye greater than snout, 2 in head, $1\frac{3}{4}$ to 2 in interorbital width." "Caudal-membrane dark orange, with black dots." "D. 14 or 15; A. 8."

Page 347. After *Mollienesia latipinna* add:

567 (*b*). **M. lineolata** (Grd.) J. & G.

Color of *M. latipinna*, the sides with five dark half-bars. Eye small, $3\frac{1}{3}$ to $3\frac{1}{2}$ in head. Dorsal fin rather small, its rays 13 (rarely 14) in number; otherwise essentially as in *M. latipinna*, of which it may be a variety. Marshes and lagoons of Louisiana and Texas.

(*Pœcilia lineolata* Grd. U. S. Mex. Bound. Surv. Ichth. 1859, 70: *Limia pœciloides* Grd. l. c. 70.)

Page 352. Instead of *Esox salmoneus* read:

574. E. umbrosus Kirt.

The *Esox vittatus* and *E. salmoneus* appear, from Rafinesque's manuscript notes, to have been mythical.

Page 355. Instead of *Muræna melanotis*, which is not yet known to occur in our waters, substitute:

578. M. retifera Goode & Bean MSS.

Body moderately stout, somewhat compressed. Teeth of upper jaw

*Among the genera of *Cyprinodonts*, only those which have the anal fin in the male modified are *known* to be viviparous. The others (*Cyprinodon*, *Fundulus*, *Zygonectes*, etc.) are probably all oviparous.

in two series, the outer series of a few short, fixed teeth; the inner series of about 10 long, compressed teeth, a few of which are depressible, all more or less directed backward; those of the middle of the jaw somewhat larger than those in front. Vomer with 1 or 2 depressible canines. Teeth of lower jaw similar to those of upper; the large teeth rather shorter and broader; teeth all entire; mouth not closing completely. The tubes of anterior and posterior nostrils about equal, slightly shorter than eye. Cleft of the mouth $2\frac{3}{4}$ times in length of head; eye over middle of cleft, $1\frac{2}{3}$ in snout. Snout 6 in head. Head $2\frac{3}{4}$ in trunk. Tail very little longer than rest of body. Dorsal moderate, beginning over the middle of head. Gill-opening small, about as broad as eye. Color light brown, regularly reticulated with blackish, the reticulations inclosing hexagonal or roundish spots of the ground color, irregular in size, longer than the eye. Entire fish further covered thickly with small whitish spots, smaller than the pupil; these spots smallest and most numerous anteriorly, nearly obsolete on the belly, and present on the inside of the mouth. Gill-opening surrounded by a small blackish blotch not twice as broad as eye. Angle of the mouth black; dorsal with about 5 longitudinal blackish lines, which are obsolete posteriorly. Anal with a blackish longitudinal stripe. Charleston, South Carolina.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 357. After *Muræna ocellata* add:

580 (*b*). **M. afra** (Bloch) Gthr.

Greenish black; fins with dark lines and without pale edge. Teeth uniserial in old examples, the vomerine teeth being sometimes biserial; mandible with about 20 teeth on each side, the four anterior much longer than the others, and, like the canines, rather elongate. Anterior nasal tubes half as long as eye. Gill-opening nearly as wide as eye. Snout narrow, produced, pointed; eye moderate, half length of snout, somewhat nearer angle of mouth than end of snout. Cleft of the mouth wide, two-fifths length of head. Tail longer than body. Head $2\frac{1}{2}$ in trunk. Dorsal not elevated. (*Günther.*) Tropical parts of the Atlantic; north to Florida.

(? *Gymnothorax afer* Bloch, Ausl. Fische. ix, 85: *Muræna afra* Günther, viii, 123, in part.)

580 (*c*). **M. moringa** Cuv. *Moray.*

Everywhere with innumerable, confluent, irregular, brownish black

spots separated by a fine network of the white ground color; each pore of the lower jaw in a round white spot; fins without white margin; in young examples the black spots are larger and fewer in number than in adults. Teeth uniserial; canines large; jaws not shutting completely; mandible with 23 to 28 teeth on each side, of which the 3 anterior are canines, the third being separated from the preceding by an interspace. Length of anterior nasal tubes less than vertical diameter of the eye. Snout produced, narrow. Eye moderate, $\frac{2}{5}$ length of snout, a little nearer angle of mouth than tip of the snout. Cleft of mouth very wide, $\frac{2}{5}$ length of head. Gill-opening a little wider than eye. Tail as long as, or somewhat longer than, body. Length of head half, or a little less than half, that of trunk. (*Günther.*) Tropical parts of the Atlantic, north to Southern Florida.

(Cuvier, Règne Anim.; Günther, viii, 120.)

Page 358. Before *Cœcula* insert:

168 (*b*).—**LETHARCHUS** Goode & Bean MSS.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882: type *Letharchus velifer* Goode & Bean.)

This genus differs from *Cœcula* (*Sphagebranchus*) in the total absence of the anal fin. The dorsal is high and begins on the head; gill-openings subinferior, nearly longitudinal; pectoral wanting. (*λήθομαι*, to forget; *αρχος*, anal.)

580 (*b*). **L. velifer** Goode & Bean MSS.

Body rather robust, somewhat compressed, its greatest depth a little more than $\frac{2}{5}$ the length of head. Head large, abruptly tapering anteriorly; snout very slender and pointed, projecting considerably beyond the lower jaw, its length $\frac{1}{10}$ head, and nearly twice the very small eye; nasal tubes rudimentary; anterior nostril under tip of snout; cleft of mouth, from tip of snout, 4 in head; eye nearer tip of snout than angle of mouth; lower jaw short and weak; tongue short, free in front; teeth small, pointed, subequal, in narrow bands on jaws and vomer; head $6\frac{1}{2}$ in trunk; head and trunk $1\frac{4}{7}$ times length of tail. Dorsal unusually high, its height at nape equalling cleft of mouth; its insertion at first third of head. End of tail sharp. Anal fin wanting. No trace of pectorals. Gill-openings large, subinferior, oblique, convergent anteriorly, their length more than three times breadth of isthmus, and equal to lower jaw. Lateral line very distinct, extending forward in a curve to below front of dorsal. Four conspicuous pores on each side of lower jaw, 3 behind each eye, 3 at the nape in front of dorsal, 1 on top of the

head, and 4 on each side of upper part of snout, besides a few smaller ones about the lips. Dark brown, slightly mottled with darker, not paler below; head paler than body; dorsal fin pale, with a broad blackish margin. West coast of Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 358. After *Cœcula scuticaris* add:

581 (*b*). **C. teres** (Goode & Bean) J. & G.

Body terete, moderately elongate, about $\frac{2}{5}$ length of head. Snout short, moderately pointed, projecting somewhat beyond lower jaw, its length $6\frac{1}{2}$ in head, $2\frac{1}{2}$ times the very small eye. Tube of anterior nostril shorter than eye. Cleft of mouth 4 in head; front of eye behind middle of cleft. Lower jaw rather short and weak; tongue not free in front. Head $8\frac{2}{3}$ times in trunk. Trunk and tail equal in length. Dorsal (as in *C. scuticaris*) beginning in front of middle of head.* Distance from tip of snout to front of dorsal $2\frac{2}{5}$ head. Dorsal of moderate height, its longest ray nearly equal to snout. End of tail acute. Anal well developed, lower than dorsal. Pectorals minute, pointed, usually shorter than eye. Gill-openings vertical (as in *C. scuticaris*), the length of one slit slightly more than breadth of isthmus, about equal to length of snout. Lateral line distinct, the pores well separated. Head without conspicuous pores. Uniform clear brown, paler below, whitish on the head; fins all pale. West Florida.

(*Sphagebranchus teres* Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 359. No. 582 may perhaps stand as—

582. O. mordax (Poey) J. & G.

The identity of the species found on our coast with *Macrodonophis mordax* Poey is certain, but the "*Crotalopsis punctifer*" of Kaup is somewhat questionable. The small vomerine teeth are in two series.

On page 359, substitute for the description of 583, *Ophichthys triserialis*:

Light olive brown; a dorsal series of large round black spots, besides two alternating lateral series; head with small spots above and below, those below elongate; dorsal and anal narrowly edged with black; pectorals with a few spots. Skin of head with longitudinal wrinkles. Length of head a little more than one-third its distance from vent. Head subconical, the snout rather long and pointed.

* Subgenus *Callechelys* Kaup, Apodes, 1856, 28: type *Callechelys guichenoti* Kaup. (κάλος, fair; ἐγχελυς, eel.)

Mouth large, the gape $2\frac{2}{5}$ in head. Eye moderate, 2 in snout, a little behind the middle of the gape. Teeth pointed, fixed, those in jaws biserial, those on vomer in one series. Pectoral $3\frac{1}{4}$ in head; dorsal beginning well in front of its tip. Tail a little longer than body. Pacific (and Atlantic?) coast of Tropical America; abundant southward; north to Southern California (*fide Cooper*).

(*Murænopsis triserialis* Kaup, Apodes, 1856, 12: *Herpetoichthys callisoma* Abbott, Proc. Acad. Nat. Sci. Phila. 1860, 475: *Ophisurus californiensis* Garrett Proc. Cal. Acad. Nat. Sci. iii, 66; Günther, viii, 58.)

Page 359. After *Ophichthys triserialis* add:

583 (*b*). **O. macrurus** Poey.

Uniform light olive, the back closely punctate, but not dark; fins all pale, the dorsal and pectoral without dark shades. Body not very slender. Head pointed, the upper jaw projecting. Eye large, more than half snout, placed above middle of gape. Gape $2\frac{2}{3}$ in head. Teeth subequal, short, slender, and sharp, more or less directed backwards; all of them biserial; no canines. Nasal tubes short, inconspicuous. Tail twice length of rest of body. Head slightly more than half trunk, nearly 9 in total. Pectorals long, $2\frac{1}{2}$ in head; dorsal beginning opposite anterior third of pectoral; distance from snout to front of dorsal $2\frac{1}{3}$ in distance to vent. Gill-openings small, rather near together. L. 15 inches. Cuba to Texas. Closely allied to *O. parilis* (Rich.), with which it is identified by Dr. Günther; but that species has very long nasal tubes.

(Poey, Repert. Fis. Nat. Cuba, ii, 256: *Oxyodontichthys macrurus* Poey, Anal. Soc. Hist. Nat. Esp. 1880, 254; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 260.)

583 (*c*). **O. chrysops** Poey.

Light olive-green; vertical fins edged with black; tip of pectoral broadly dusky. Teeth all biserial, none of them very large or canine-like. Head conical, the snout short but rather sharp. Mouth rather large, its gape about $2\frac{3}{5}$ in head; jaws and top of head with numerous dark-colored pores. Dorsal beginning a little before tip of pectoral. Lateral line of rather coarse pores. Length of head and body about $2\frac{5}{7}$ times in total length. West Florida to Havana, in rather deep water. The reproductive apparatus in this species in both sexes resembles that of ordinary fishes, the ovaries in the female being very large, with the eggs exceedingly numerous.

(? *Ophisurus gomesii* Castelnau, Anim. Amér. Sud. Poiss. 1855, 84, Rio Janeiro: ? *Ophichthys gomesii* Günther, viii, 60: *Ophisurus chrysops* Poey, Mem. Cuba, ii, 321; Poey, Syn. Pisc. Cub. 1868, 425: *Oxyodontichthys chrysops* Poey, Anal. Soc. Hist. Nat. Esp. 1880, 254.)

Page 359. After *Ophichthys ocellatus* add:

170 (*b*).- **PISODONTOPHIS** Kaup.

(*Pisoodonophis* Kaup, Apodes, 1856, 15: type *Ophisurus cancrivorus* Rich.)

Teeth all, or nearly all, more or less rounded or granular. Otherwise essentially as in *Ophichthys*. (πισον, pea; ὀδους, tooth; ὀφις, snake.)

584 (*b*). **P. longus** (Poey) Goode & Bean.

Body extremely elongate, its greatest depth little more than $\frac{1}{3}$ length of head. Snout rather pointed, its length $5\frac{2}{3}$ in head and twice diameter of eye. Tubes of anterior nostril nearly as long as eye. Cleft of mouth 3 in head; the front of eye slightly behind its middle. Teeth all blunt and rounded, biserial; those of the front of jaws considerably larger than the rest. Head 4 in trunk. Head and trunk $1\frac{2}{3}$ in tail. Dorsal beginning at nape, at a point slightly nearer base of pectoral than eye, the fin of moderate height, higher than the anal; end of tail sharp. Pectorals extremely small, rounded, broader than long, the breadth of their bases equal to depth of gill-opening. Ground color dark brown, pale below; each side with 2 series of round, whitish blotches, about 40 spots in each series; spots somewhat largest and most distinct anteriorly, where their diameter is nearly equal to length of snout. Head with irregular round whitish spots on each side. Dorsal brownish, margined with dusky; other fins pale. Florida to Cuba.

(? *Muræna acuminata* Gronow, Syst. Ichth. Ed. Gray, 1854, 21: *Ophisurus longus* Poey, Rep. Fis. Nat. Cuba, 1868, 254: *Ophichthys acuminatus* Günther, viii, 83.)

Page 360. After *Myrichthys tigrinus* insert:

171 (*b*).—**MYROPHIS** Lütken.

(Lütken, Vid. Med. Naturh. Foren. Kjöbenh. 1851, 1: type *Myrophis punctatus* Lütk.)

Body elongate, subcylindrical, scaleless. Vertical fins low, meeting around the tail, the dorsal beginning far behind the pectoral, which is small. Mouth moderate, its cleft extending beyond the eye; upper jaw longest; teeth moderate, in 1–3 series. Nostrils on the margin of the upper lip, the anterior tubular. Size small. (μυρος, *Myrus*; οφις, snake.)

585 (*b*). **M. lumbricus** J. & G.

Light olive, everywhere except below finely punctulate; some very faint roundish yellowish spots; eyes green; lower side of head with steel-blue luster. Body worm-shaped, tapering backwards and scarcely compressed; diameter of head less than that of body. Head very small,

slender, and pointed, the narrow upper jaw much projecting; eye much nearer angle of mouth than tip of snout, its length 2 in snout. Teeth rather strong, slender, sharp, apparently uniserial, the series on vomer largest. Gape short, 4 in head; nasal tubes very short. Pectorals minute, rounded, scarcely larger than eye. Dorsal beginning nearer gill-opening than vent, at a distance behind gill-opening equal to length of head. Head $10\frac{2}{3}$ in total; head with trunk $1\frac{2}{3}$ in tail; head 4 in trunk. Height of body 30 in length. Galveston, Texas.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 261: ??*Myrophis punctatus* Lütken, l. c.: ??*Myrophis longicollis* Kaup, Apodes, 30.)

585 (*c*). **M. microstigmius** Poey.

Distinguished from *M. lumbricus* chiefly by the more posterior insertion of the dorsal, which begins at a point midway between gill-opening and vent. (*Poey.*) Cuba to Southern Florida.

(Poey, Repert. Fis. Nat. ii, 250; Günther, viii, 51.)

Page 360. In *Neoconger mucronatus* the anal fin is well developed for its entire length; not "rudimentary," as stated by Girard.

Page 363. After *Conger niger* add:

588 (*b*). **C. caudicula** Bean MSS.

Olivaceous. Head a little more than $1\frac{1}{2}$ times in trunk, 6 times in total length; tail short, its length exceeding that of rest of animal by length of head without snout. Eye equal to snout, $4\frac{1}{2}$ in head; lips moderate; anterior nostril tubular; lower jaw included; cleft of mouth reaching hinder margin of pupil; patch of vomerine teeth $\frac{1}{3}$ length of eye; 38 close-set teeth in outer series of upper jaw; behind them 6 conical teeth directed partly forward; teeth in both jaws biserial. Dorsal beginning over posterior part of pectoral; pectoral a little more than $\frac{1}{3}$ head. Pensacola, Florida, in deep water. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. 1882.)

Page 370. After *Notacanthus chemnitzi* add:

595 (*b*). **N. phasganorus** Goode.

Body much compressed, its greatest width about one-third its height. Head everywhere covered with very small scales, its bones very flexible but protected by leathery skin. Interorbital width more than length of snout, 4 in head, twice diameter of eye. Mandible twice length of eye; maxillary considerably greater. Teeth of upper jaw slender, blunt, close-set, like comb-teeth, 32 on each side; teeth of lower jaw shorter, slenderer, in two rows; palatines with villiform teeth in about two se-

ries. Distance from snout to dorsal $2\frac{3}{4}$ times length of head, its length nearly twice length of head; anal beginning close behind vent, its length half the body. Pectoral short and rounded, its length (uncertain) about one-third the head. Ventrals broad, with peduncle-like bases thickly covered with scales; closely adjacent, separated by a narrow groove. Head $7\frac{1}{2}$; depth 9. D. X; A. XIX, 130; P. about 17; V. II, 9; B. 8; scales about 20–400–36. Grand Bank, Newfoundland. (*Goode.*) One large specimen known, taken from the stomach of a *Somniosus.*

(Goode, Proc. U. S. Nat. Mus. iii, 535, 1880.)

Page 373. To the account of *Tylosurus hians* add:

Body slender, very strongly compressed, nearly twice as deep as broad. Tail without keel. Caudal deeply and subequally forked; ventrals inserted much behind middle of body (not a little before middle, as stated by C. & V.). Side with a series of faint roundish bluish blotches; pectoral blackish, pale at base. Head $3\frac{1}{2}$ to $3\frac{2}{3}$ in length in adult examples. D. 24; A. 25.

(? *Belone hians* C. & V. xviii, 432, and Giinther, vi, 248: *Belone maculata* Poey, Mem. Cuba, ii, 290.)

Page 373. Instead of *Tylosurus latimanus* read:

597. T. caribbæus (Le S.) J. & G.

To the description in the text add:

Body very elongate, subterete, the depth little more than the breadth of body, and considerably less than length of postorbital part of head. Tail scarcely depressed, but with a small black dermal keel. Young and half-grown specimens with the last rays of dorsal elevated, nearly or quite as high as anterior rays; adults with the posterior rays of dorsal low, not longer than the median. Caudal unequally forked. Jaws rather strong, slenderer in the young. Scales very small. Tip of pectoral black. Head $3\frac{1}{2}$ in adults; 3 in young. D. 24; A. 22. L. 4 feet. West Indies; occasional northward.

(*Belone carribæa* Le Sueur, Journ. Acad. Nat. Sci. Phila. ii, 127, 1823: *Belone latimana* Poey, Mem. Cuba, ii, 292, 1860: *Belone caribbæa* Günther, vi, 241: *Belone latimanus* Günther, vi, 249.)

Page 374. After *Tylosurus exilis* add:

600 (*b*). **T. gladius** Bean MSS.

Green; pectorals and dorsal blackish. Body robust, little compressed, its greatest breadth a little more than $\frac{2}{3}$ greatest depth; caudal peduncle slightly depressed, a little broader than deep, with a slight black dermal keel. Head broad, interorbital space nearly $\frac{2}{3}$ length of postorbital part of head, with a broad, shallow, nearly naked median

groove, which is wider behind and forks at the nape. Supraorbital bones with radiating striæ. Jaws unusually short, stiff, strong, rapidly tapering forwards; large teeth of jaws very strong, knife-shaped. Upper jaw from eye about $1\frac{3}{4}$ times as long as the rest of head. Eye large, 7 in snout, $2\frac{2}{3}$ in postorbital part of head, and $1\frac{4}{5}$ in interorbital width. Maxillary entirely covered by the preorbital. Cheeks densely scaled; opercles mostly naked except along the anterior margin. Scales of body minute, especially above. Dorsal fin low posteriorly; the height of its anterior lobe equaling that of anal, or length of postorbital part of head; its longest ray $\frac{2}{5}$ the base of the fin; caudal lunate, its lower lobe nearly half longer than the upper; middle rays about as long as eye. Ventrals inserted midway between base of caudal and middle of eye, their length a little less than that of pectoral, and equal to postorbital part of head. Head $3\frac{1}{3}$; depth 13. D. I, 22; A. I, 20; P. 14. Pensacola, Florida; a large species, remarkable for the great strength of its short jaws.

(Bean, Proc. U. S. Nat. Mus. 1882.)

Page 374. Instead of *Tylosurus longirostris* read:

509. T. marinus (Bloch & Schn,) J. & G.

To the synonymy add:

(*Esox belone*, var. *marinus* Bloch & Schneider, Syst. Ichth. 1801, 391.)

Page 377. After *Hemirhamphus rosæ* add:

b. Ventrals much nearer base of caudal than head.

604 (*b*). **H. brasiliensis** (L.) Gthr.—*Balao.*

Greenish above, sides silvery, the lateral silvery stripe very indistinct. Body not very slender, compressed. Lower jaw (from end of upper jaw) $4\frac{2}{5}$ in length from its tip to base of caudal. Head, without mandible, 5 in length from tip of upper jaw. Premaxillaries broader than long. Eye large, equal to interorbital space, $\frac{2}{3}$ postorbital part of head. Ventrals inserted very far back, midway between base of caudal and tip of pectoral; vertical fins scaly; anal much smaller than dorsal; last ray of dorsal slightly produced; pectoral $\frac{3}{4}$ length of head; ventrals $2\frac{3}{4}$ in head; caudal deeply forked, the lower lobe longest. Head (with lower jaw) $2\frac{3}{4}$; depth $6\frac{2}{3}$. D. 14; A. 12; Lat. l. 53. Tropical America; a specimen lately taken on the coast of Virginia by Dr. J. T. Wilkins.

(*Esox brasiliensis* L. Syst. Nat. i, 517, in part, the name and fin rays taken from Marcgrave's account of *Tylosurus timucu*; Günther, vi, 270: *Esox brasiliensis*, Bl. & Schn. 392: *Hemirhamphus marginatus* and *balao* Le Sueur, Journ. Acad. Nat. Sci. Phila

ii, 135, 136, 1823: *Hemirhamphus browni* and *pleii* C. & V. xix, 13, 19: *Hemirhamphus pleii* Günther, vi, 269: *Hemirhamphus filamentosus* Poey, Mem. Cuba, ii, 297, 1860.)

Page 377. The genus 183 (*b*) *Euleptorhamphus*, should probably be recognized. After *Euleptorhamphus longirostris* add:

183 (*c*).—**CHRIODORUS** Goode & Bean MSS.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882: type *Chriodorus atherinoides* Goode & Bean.)

Body and fins as in *Hemirhamphus*, but both jaws very short, not at all produced, each with two series of large, tricuspid, incisor teeth, which form a continuous cutting edge. Maxillary anchylosed to premaxillary. Ventral fins small, median. (χρεια, want; δορος, lance.)

605 (*b*). **C. atherinoides** Goode & Bean MSS.

Light olive; sides with a narrow, silvery band. Interorbital space broad, unevenly convex, its width equal to eye, which is $3\frac{1}{6}$ in head, as long as snout; premaxillaries much broader than long, their edges concave; maxillary 4 in head; mandible $2\frac{1}{4}$, its tip broadly rounded, not at all produced. Dorsal opposite anal and entirely similar to it; both fins elevated in front, but not falcate, their longest rays half head; caudal moderate, deeply and subequally forked; ventrals $2\frac{1}{6}$ in head, their insertion midway between snout and base of caudal; pectorals $1\frac{1}{2}$ in head; vertical fins with small scales. Scales moderate, deciduous. Head $4\frac{3}{5}$; depth $6\frac{3}{4}$; breadth of body $\frac{3}{5}$ its depth. D. I, 14; A. I, 15; V. 6; P. 12; scales 7–46–3. L. $8\frac{1}{2}$ inches. Key West, Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 379. Before *Exocœtus californicus* insert:

607 (*b*). **E. hillianus** Gosse.

Dark green, silvery below, tinged with pinkish; dorsal translucent, with a large black blotch on upper anterior half; caudal brick-red; pectoral translucent, dusky; ventrals more or less dusky, with a small black spot at base of outer ray. Body moderately compressed. Head short, the short snout one-fourth its length; eye 3 in head, equal to the flat interorbital space. Pectoral reaching middle of anal, its length $1\frac{4}{5}$ in body; its second ray simple, scarcely shorter than third. Insertion of ventral slightly nearer root of caudal than tip of snout, its tip extending slightly past front of anal, its length $1\frac{1}{7}$ in head. Dorsal very high, its anterior rays reaching anal. Head $4\frac{1}{3}$; depth 5; D. 12; A. 14; scales 38–5. L. 8 inches. West Indies, north to West Florida and South Carolina.

(Gosse, Nat. Sojourn Jamaica, 11: Poey, Mem. Cuba, ii, 301: Günther, vi, 384.)

Page 379. Instead of *Exocœtus noveboracensis* read:

609. E. rondeletii C. & V.

The specimen described in the text came from the open sea, south of Newfoundland. The species is well distinguished from *E. noveboracensis*, by the black ventrals, the larger anal and shorter dorsal, the base of the anal being more than $\frac{2}{3}$ that of the dorsal; the head is blunt and the eye comparatively small; dorsal beginning slightly before anal; caudal large, its lower lobe half longer than head. D. 11 or 12; A. 11 or 12 (not 9); Lat. l. 42. New England to Mediterranean Sea.

(Cuv. & Val. xix, 115; Günther, vi, 293.)

Page 379. After *Exocœtus rondeletii* read:

610. E. noveboracensis Mitchill.

Dark bluish; pectorals blackish at tip, with a median whitish shade; ventrals white. Head rather slender, the snout not blunt; eye very large, $2\frac{5}{6}$ in head; interorbital space rather narrow. Pectoral shorter and narrower than in *E. rondeletii*, barely reaching last ray of dorsal; first ray of pectoral divided; ventrals extending past anal, their insertion midway between preopercle and base of caudal; dorsal beginning considerably in advance of anal, the length of its base more than twice that of anal; lower lobe of caudal not $\frac{1}{3}$ longer than head. Head $4\frac{2}{3}$; depth $5\frac{1}{3}$. D. 14; A. 9; Lat. l. 45. Atlantic coast; specimens examined from Wood's Holl and Pensacola.

(Mitchill, Amer. Monthly Mag. ii, 233, 1817; Dekay, New York Fauna, Fish. 230; C. & V. xix, 99: *Exocœtus melanurus* C. &. V. xix, 101.)

Page 379. The description in the text of "*E. melanurus*" is taken from an adult example of *E. exiliens*, the young of which is described as *E. exiliens* on page 380. *E. melanurus* is therefore to be suppressed. *E. exiliens* is comparatively slender, the anal fin beginning opposite front of dorsal, its base $\frac{3}{4}$ length of base of dorsal; lower caudal lobe short, shorter than head. D. 11; A. 12 (not 9, as erroneously stated in the text).

Page 383. Instead of the foot-note add:

614 (*b*). **S. affine** (Gthr.) J. & G.

The specimen from St. John's River, described in the foot-note on page 383, belongs to *S. affine*. The body, in the female, is marked by silvery cross-streaks, which are very distinct in life.

Page 384. In *S. louisianæ* the rings are usually 20+38 in number; the dorsal rays 32 to 35.

Page 384. After *Siphostoma louisianæ* add:

615 (*b*). **S. floridæ** J. & G.

Dark green, with paler streaks; tail faintly barred. Body slender; snout long, one-third longer than rest of head; nape and opercles without keel; dorsal fin on 1+6 or 7 rings. Tail one-fifth longer than trunk; rings 18+31. Caudal pouch in male on 18 rings. Head about 6; D. 27; L. 8 inches. North Carolina to Western Florida; abundant at Pensacola and Beaufort.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

Page 384. After *Siphostoma californiense* add:

616 (*b.*) **S. griseolineatum** (Ayres) J. & G.

Very close to *S. californiense*, but the size smaller, the snout shorter, and the number of rays and rings different. Dorsal covering 1+9 rings. Snout in head $1\frac{3}{4}$ times. Dorsal rays 36 to 41; rings 18 to 19+39 to 42. L. 10 inches. San Francisco to Puget Sound.

(*Syngnathus griseolineatus* Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 14, etc.)

616 (*c*). **S. bairdianum** (Dum.) Swain.

Blackish, with pale lines; fins mottled. Body unusually stout, with short head and tail. Snout short, compressed, with a sharp keel above, in the male just as long as head, probably longer in female. Nape and opercle without keel. Dorsal fin low. Rings 18 + 31. D. 34, placed on 1 + 7 rings. Ten rings on tail behind caudal pouch. Head $7\frac{2}{3}$ in length. Santa Barbara, California.

(*? Syngnathus bairdianus* Duméril, Hist. Nat. Poiss. ii, 1870, 574; "Coast of Mexico, near California" (dorsal said to be inserted on 3 + 6 rings); Swain, Proc. U. S. Nat. Mus. 1882.)

Page 384. The species described in the foot-note as *Siphostoma dimidiatum* is a valid species, and should stand as—

617 (*b*). **S. auliscus** Swain.*

Syngnathus dimidiatus Gill was based on short-nosed examples of *S. leptorhynchus*.

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* Swain, Proc. U. S. Nat. Mus. 1882.

The following analysis of the species of *Siphostoma* found in the United States is given by Mr. Swain (Review of the North American Pipe-fishes, l. c.):

a. Top of head strongly carinated.

b. Breast-shields not covered by soft skin; lower jaw slightly included; opercle with a prominent ridge; snout short; belly concave; dorsal rays 20, its base covering 1 + 4 rings; rings 18 + 30; body with 12 brown cross-bands..... ZATROPIS.

bb. Breast-shields covered by soft skin; lower jaw included; dorsal rays 41; rings 19 + 39..... PUNCTIPINNE.

Page 385. After *Siphostoma punctipinne* add:

xx. Top of head with a strong interrupted median crest. (*Corythrichthys* Kaup.)

616 (*c*). **S. zatropis** J. & G.

Brownish, with ten broad dark cross-bands which encircle the tail but do not cross the belly anterior to the vent; snout whitish, with two narrow dark bands; lower part of head with white cross-streaks. Snout as long as postorbital part of head, keeled above. Head small. Occiput and nape with a strong, compressed crest, on each side of which is a longitudinal ridge; opercle with a median keel. Ridges of body very prominent. Tail one-third longer than rest of body. Dorsal on 1 + 4 rings. Dorsal rays 20; rings 18 + 30. Head 9. Gulf of Mexico, north to Pensacola.

(?? *Corythroichthys albirostris* Kaup, Lophobranchs, 25: *Syngnathus albirostris* Günther, viii, 170; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 264; Swain, Proc. U. S. Nat. Mus. 1882.)

Page 386. The identity of 619 (*a*) with the European *H. heptagonus* (*antiquorum*) is questionable. None of the American examples seen by us are spotted, and their spines are stronger than in European examples.

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aa. Top of head with a slight keel or none; opercle without prominent longitudinal ridge.

c. Dorsal covering 1 + 9 rings; snout usually long.

d. Rings 20 to 21 + 45 to 49; dorsal rays 39 to 46; top of head not keeled; large, reaching a length of 18 inches..... CALIFORNIENSE.

dd. Rings 18 to 19 + 39 to 42; dorsal rays 36 to 41; top of head slightly keeled. GRISEOLINEATUM.

cc. Dorsal covering 1 + 7 (rarely 1 + 6) rings.

e. Rings 15 + 38; dorsal rays 29 to 30; top of head distinctly keeled; snout short..... AULISCUS.

ee. Rings 16 to 19 before vent.

f. Dorsal fin low, not longer than head.

g. Rings 18 + 31; dorsal rays 34; snout short; body little elongate. BAIRDIANUM.

gg. Rings 17 to 19 + 36 to 41; dorsal rays 30 to 32; snout moderate or rather short..... LEPTORHYNCHUM.

ggg. Rings 17 to 18 + 31 to 32; dorsal rays 27; snout rather long; body slender. FLORIDÆ.

ff. Dorsal fin very high, longer than head, its rays 28 to 32; rings 16 + 30 to 33; snout rather short; belly in the female with a black carina; sides of body with narrow vertical silvery streaks in life; dorsal spotted..... AFFINE.

ccc. Dorsal covering 3 + 5 rings; rings 20 or 21 + 36 to 38; dorsal rays 32 to 37; belly flat or slightly concave; snout medium..... LOUISIANÆ.

cccc. Dorsal covering 4 + 5 or 5 + 4 rings; rings 18 to 20 + 36 to 40; dorsal rays 36 to 40; snout medium..... FUSCUM.

Page 386. After *Hippocampus heptagonus* add:

619 (*b*). **H. guttulatus** Guich.

Dark brown, marbled with darker, and usually everywhere spotted with whitish, the spots most numerous posteriorly. Tubercles on body generally obtuse and blunt; coronet low; snout usually a little longer than preorbital part of head. Dorsal rays 17. Supraorbital spine obliquely truncate, compressed. Size rather large. Tropical seas, north to our South Atlantic and Gulf coast.

(?? *Hippocampus guttulatus* Cuvier, Règne Anim.: *Hippocampus guttulatus* Günther, viii, 202: Guichenot, in Ramon de la Sagra Poiss. Cuba, 174, the West-Indian form, which is apparently different from the European species called "*guttulatus*.")

619 (*c*). **H. hudsonius** Dek.

Dusky, without spots, but with pale grayish blotches, which are sharply edged with paler and blackish; some of these between eyes and on neck, the most distinct blotch forming an hour-glass shaped figure, extending down each side of back; similar blotches on belly and tail. Dorsal with a submarginal dark band. Depth equal to length of head. Snout $1\frac{1}{3}$ in rest of head. Spines of head weak, provided with cirri; spines of body all short and bluntish. Dorsal on $3\frac{1}{2}$ of the 11 body rings. D. 19. Atlantic coast, from Cape Cod southward. (Described from No. 19520, U. S. Nat. Mus., from Beaufort, N. C.)

(Dekay, N. Y. Fauna, Fish. 1842, 322.)

619 (*d*). **H. stylifer** J. & G.

Brownish, with darker bars; snout blackish. Snout notably longer than postorbital part of head; supraocular and temporal spines long, simple; a long median spine in front of coronet; coronet stout, high, its spines slender, abruptly spreading. Spines of body very long and slender, each ending in a filament; these enlarged on each alternate plate of the neck, and about every fourth plate on body and tail; dorsal and upper lateral ridge usually armed and sometimes lower lateral ridge; two strong spines at base of pectoral; body with about 50 developed spinous processes besides numerous smaller points. D. 16, covering about 4 body rings; rings about 12 + 31. Coasts of Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 265.)

619 (*e*). **H. zosteræ** J. & G.

Olive green; sides of head mottled with paler; dorsal marbled with dusky, its margin (in ♂) broadly red. Snout very short, not more than half rest of head; supraorbital spines diverging, each with a small spine before it. Coronet high, two-thirds length of snout; its filaments

about as long as snout. Spines on body well developed. Dorsal on 2 + 1 rings; the fin high and very short. D. 12; rings 11 + 26 to 30. L. 2 inches. Pensacola Bay.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 265.)

Page 391. The ventral rays in *Aulorhynchus* are I, 4, not I, 5 as erroneously stated in the text.

Page 403. *Mugil mexicanus* is certainly specially identical with *Mugil albula*, and may, therefore, be suppressed.

Page 405. The types of *Atherina carolina* C. & V., examined by us in the Museum at Paris, show the following additional characters:

A true *Atherina*. Eye large, 2½ in head. Scales nearly or quite entire. Spinous dorsal wholly in advance of the vent. Ventral reaching past front of vent and dorsal nearly to it. Head 4½. Lat. l. 52.

Page 406. In *Labidesthes*, the premaxillaries, though broadened behind, are much narrower than in *Menidia*, and but little broader than in *Atherina*.

Page 406. The date of the name *Menidia* is apparently 1836.

Page 407. Instead of *Menidia bosci* read:

640. M. vagrans subsp. **laciniata** Swain, sp. nov.

Coast of North Carolina. The synonymy given in the text (page 407) belongs to No. 644.

Page 407. In *Menidia vagrans* the scales are all very firm, with rough edges. A. I, 15 to I, 18. Silvery band broad; back with lines of dots following the rows of scales; pectoral and caudal yellowish in life. Soft dorsal and anal scaly. Florida to Texas.

Page 408. After *Menidia notata* add:

642 (*b*). **M. audens** Hay, sp. nov.

Color and form of *M. notata;* edges of scales somewhat dotted; a dusky streak at base of anal. Head rather broad and flat above. Mouth small. Eye 3 in head, equal to snout and to interorbital space. Vent a longitudinal slit, its length two-thirds diameter of eye. First dorsal spine inserted immediately above anterior part of anal slit, slightly nearer base of caudal than snout. Pectorals extending to beyond bases of ventrals, their length four-fifths head. Ventrals reaching vent. Interspace between dorsals twice diameter of eye. Top of head covered with large scales. Lateral silvery band on fifth row of scales and edges of fourth and sixth rows; the extreme parts of fifth row not included in it. Scales with entire edges, which are nearly straight, so that

each scale is angulated behind. Soft dorsal naked. Head 4½; depth 6. D. IV or V–I, 8 or 9; A. I, 17 or 18; scales 45–10. L. 3 inches. Mississippi River; the types from Memphis and Vicksburg. (*Hay* MSS.)

Page 408. Under *M. beryllina* read "two half-row of scales," instead of "2½."

Page 408. Instead of *Menidia brasiliensis* read:

644. M. bosci (Cuv. & Val.) Swain.

Distinguished from *M. notata* by the deeper body and stronger teeth. The soft dorsal and anal, as in other smooth-scaled species, are free from scales. D. IV–I, 8; A. usually I, 24. South Carolina to Florida.

(*Atherina menidia* L. Syst. Nat.: *A. bosci* C. & V. X, 465; not *A. brasiliensis* Q. & G.)

Page 415. The genus and species "*Argyrotænia vittata*" should be erased from the system. We have little doubt that they are based on a specimen of *Ammodytes americanus*. Our alleged species of *Ammodytidæ* are perhaps all forms of *Ammodytes tobianus* L. *A. personatus*, at least, is not distinguishable from *A. americanus*.

Page 417. To the synonymy of *Echeneis remora* add:

(*Echeneis squalipeta* Daldorf Nat. Selskab. ii, 157, about 1785; and Günther ii, 157. If the subgenus *Remora* Gill, be adopted as a genus, which may be desirable, this species should stand as *Remora squalipeta* (Dald.) J. & G.)

Page 418. *Elacate canada* is known in Florida as "Sergeant-fish," from its lateral stripes; also, as "Snooks" and "Ling."

Page 420. Instead of *Tetrapturus albidus* read:

663. T. indicus C. & V.

Tropical seas, northward to the Grand Banks, on our Atlantic coast. Instead of the synonymy in the text, substitute the following:*

(C. & V. Hist. Nat. Poiss. viii, 1831, 286: *Tetrapturus herschelii* Gray, Ann. Nat. Hist. i, 313, 1838: *Tetrapturus herschelii* Lütken, Spolia Atlantica, 1880, 441: *Histiophorus herschelii* Günther, ii, 513: *Tetrapturus albidus* Poey, Mém. Cuba, ii, 237, 1858: ? *Tetrapturus amplus* Poey, Mém. Cuba, ii, 243: *Histiophorus brevirostris* Gthr. and Playfair, Fish. Zanzibar, 1866, 53: *Tetrapturus georgii* Lowe, Proc. Zoöl. Soc. Lond. viii, 36, 1840: *Tetrapturus lessonii* Canestrini, Arch. Zoöl. i, 259, 1861; Goode, Proc. U. S. Nat. Mus. 1881, 418 (detailed review of family): not *Tetrapturus belone* Raf.=*T. imperator* (Bloch & Schneider) Goode, a distinct species, known only from the Mediterranean.)

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* This synonymy is given in accordance with the views of Dr. Lütken, who recognizes but five species of *Xiphiidæ*. This view is probably correct but, as has been pertinently observed by Professor Goode, the identity of the American species called *Tetrapturus albidus* and *Histiophorus americanus*, with their Old World representatives, is yet unproven, and in many respects it is desirable to retain the American names until this identity is shown. "To unite species from widely distant localities, without ever having seen them, is very disastrous to a proper understanding of the problems of geographical distribution." (Goode, Proc. U. S. Nat. Mus. 1881, 427.)

Page 422. After *Trichiurus lepturus** add:

212 (*b*).—**BENTHODESMUS** Goode & Bean.

(Goode & Bean, Proc. U. S. Nat. Mus. 1881, 379: type *Lepidopus elongatus* Clarke.)

Body naked, much compressed, band-like, tapering gradually backward from the vent; caudal peduncle very slender, the caudal fin small, but well developed; vent much nearer snout than tip of tail. Lateral line simple, nearly straight, in a deep, wide furrow. Head compressed; the snout gibbous near its tip; top of head very flat, concave between the eyes, without occipital crest; lower jaw with a stout cutaneous appendage. Three very long, simple, compressed teeth on each premaxillary in front; outside of these a few minute teeth, and behind them a row of large sharp teeth; lower jaw with a single row of rather large, pointed teeth, those in middle of the jaw largest. Palatine teeth minute. Nostrils horizontal. Dorsal fin nearly uniform, the spines and soft rays similar; anal extremely low, preceded by a scale-like appendage. Caudal forked. Ventrals each reduced to a minute, scale-like spine, inserted below pectorals. Gill-rakers short, spiny, in one series on first and second arch; obsolete on third and fourth. Deep water. (βενθός, deep; δεσμός, band.)

666 (*b*). **B. elongatus** (Clarke) G. & B.

Silvery, with dark traces on head and tail. Length of caudal peduncle half greatest depth of body, its least depth one-third interorbital width, which is 4 in head. Snout $2\frac{1}{2}$ in head; maxillary not reaching front of eye, as long as postorbital part of head. Gill-rakers 13 on first arch. Dorsal fin inserted above middle of opercle; pectoral as long as maxillary. Head $7\frac{1}{2}$; depth 30. D. 154; A. 100; P. 12; V. I, 1. (*Goode & Bean.*) Deep seas; known originally from Hokitika, New Zealand; a specimen lately taken from the stomach of a halibut on the Grand Banks of Newfoundland.

(*Lepidopus elongatus* F. E. Clarke, Trans. New Zealand Inst. xi, 294, 1878, pl. xiv; Goode & Bean, Proc. U. S. Nat. Mus. 1881, 379.)

Page 424. After *Scomber pneumatophorus* read:

667 (*b*). **S. colias** Gmelin.—"*Spanish Mackerel*" *of Europe.*

Our Atlantic and Pacific representatives (*grex* Mitch.; *diego* Ayres) of *S. pneumatophorus* seem to be identical, but both differ in some respects from the European "Spanish Mackerel." *S. colias* Gmel. has the head longer, $3\frac{1}{2}$ to $3\frac{3}{4}$ in length (instead of 4); its spinous

* This species is known as "*Sabre-fish*" and "*Silver Eel*," on the coast of Texas.

dorsal is lower, the longest spines not more than half of head; the color is distinctly different. In *S. pneumatophorus* the dark bands on the back are broader than the interspaces, as broad as pupil; these are usually confluent below with a narrow dark lateral streak, which runs about on the level of the upper edge of the pectoral; below this streak the sides and belly are immaculate. In *S. colias* (specimens from Charleston, S. C., and from Genoa) the dark dorsal bands are much narrower, not so broad as the interspaces and more wavy; the lateral streak is obsolete or represented by a line of dots, and the sides below are marked by numerous irregular, wavy vertical streaks, spots, and reticulations, of a dull pearly-gray color, which are usually broader than the interspaces; longest D. spine more than $\frac{1}{2}$ head. The fin rays are the same in the two species.

(*Scomber colias* Gmelin, Syst. Nat. i, 1329, 1788; C. & V. viii, 309; Gthr. ii, 361: *Scomber dekayi* Storer, Fish. Mass. 52.)

Page 424. In the description of *Scomber scombrus* read "depth 5," not $5\frac{1}{2}$.

Page 425. For *Auxis rochei* read:

669. A. thazard (Lac.) J. & G.

And add to its synonymy:

(*Scomber thazard* Lac. Hist. Nat. Poiss. iii, 9, 1802: *Auxis taso* C. & V. viii, 146.)

Page 427, last line, omit the words "P. 10."

Page 430, second line, omit the word *Baird.*

Page 432. The following diagnoses of the species of *Trachurus* may be substituted for those given in the text:

680. T. picturatus (Bowdich) J. & G.—*Horse Mackerel.*

Body elongate, little compressed, the depth 5 in length; scutes 50 + 46 to 48, the anterior scutes one-third lower than the posterior, their height $2\frac{1}{3}$ in diameter of eye; curve of lateral line scarcely shorter than straight part; maxillary scarcely reaching beyond front of eye, $2\frac{2}{3}$ in head; lining of opercle scarcely blackish. Coast of Southern California to Chili; Mediterranean.

(*Seriola picturata* Bowdich, Excursion Madeira, 1825, 123: *Trachurus cuvieri* Lowe, Trans. Zool. Soc. Lond. ii, 183, 1837: *Caranx trachurus* 2ème subdiv. C. & V. iii, 18: *Caranx amia* Risso, Ichth. Nice, 1810, 74 (not *Scomber amia* L.): *Caranx symmetricus* Ayres, Proc. Cal. Ac. Nat. Sci. i, 62, 1855: *Trachurus fallax* Capello, Cat. Peix. Portugal, 1867: *Trachurus rissoi* Giglioli, Cat. Anfibi. Pesci. Ital. 1880, 27.)

681. T. saurus Raf.*

Body comparatively deep and compressed, the depth 4; scutes 34 to 36+36 to 38, the anterior scutes scarcely lower than the posterior, their height three-quarters diameter of eye; length of curve of lateral line $1\frac{3}{7}$ to $1\frac{2}{5}$ in straight part; maxillary reaching past front of pupil, $2\frac{1}{4}$ to $2\frac{1}{2}$ in head; lining of opercle dusky. Coasts of Europe; occasional on our South Atlantic and Gulf coasts.

(*Scomber trachurus* L. Syst. Nat. Cuv. & Val. ix, 11: *Trachurus trachurus* Day, Fish. Gt. Brit. 1880, 124: ?? *Caranxomorus plumierianus* Lac. Hist. Nat. Poiss. iii, 84, pl. 11: *Trachurus saurus* Raf. Caratteri, etc. 1810, 20.)

Page 435. *Caranx pisquetus* is known on the Gulf coast as "Hard-tail" or "Jurel"; *Decapterus punctatus* as "Cigar-fish". The lateral scutes in *Caranx cibi* are about 28 in number, as in *C. beani*, which is possibly the young of the same species.

Page 436. Instead of *Caranx falcatus* read:

689. C. amblyrhynchus C. & V.

Add to its synonymy:

(*Caranx amblyrhynchus* C. & V. ix, 100, pl. 248.)

Page 437. *Caranx fallax* can hardly be said to have "canine teeth," the teeth being smaller than in *C. hippus*.

Page 443. *Trachynotus goreensis*, the "Permit" of the Florida coast, is probably distinct from *T. ovatus*, differing in the much more elongate form. It reaches a large size. *Trachynotus glaucus*, the "Gaff-top-sail Pompano," rarely grows beyond a foot in length. In the description of the latter the words "Lower California" should be erased.

Page 444. Instead of *Seriola lalandi* read:

701. S. dorsalis (Gill) J. & G.

The identity of the Californian "Yellow-tail," with the *Seriola lalandi* of the Atlantic is questionable. For the synonymy of the species substitute:

(*Halatractus dorsalis* Gill, Proc. Ac. Nat. Sci. Phila. 1863, 84.)

A species apparently the true *lalandi*, however, occurs on the coast of Florida and may be added as—

701 (*b*). **S. lalandi** C. & V.

It agrees in general with the description of No. 701, but the mouth

*The description of *T. saurus* given in the text was taken from specimens from Venice, belonging to a third species or variety (*declivis* Jenyns) not yet found in America north of Cape San Lucas. Its scutes are usually 38 to 40+38 to 42. In form and other characters it is intermediate between *saurus* and *picturatus*.

is larger, the maxillary $2\frac{2}{5}$ in head, instead of $2\frac{2}{3}$; and the dorsal rays are V–I, 32 or 33. Florida to Brazil; reaching a large size.

(C. & V. ix, 208; Günther, ii, 463: *Seriola gigas* Poey, Mem. Cuba, ii, 230.)

Page 445. After *Seriola rivoliana* add:

702 (*b*). **S. falcata** C. & V.—"*Rock Salmon*" (Pensacola).

Grayish, paler below; fins blackish; pectoral pale; a very faint olivaceous band from the eye to the nape (corresponding to the black band in *S. rivoliana*, but scarcely visible). Body deep, compressed; head compressed, not conical, a little longer than deep; snout $2\frac{3}{4}$ in head; maxillary reaching front of pupil, $3\frac{2}{5}$ in head; occiput somewhat carinate; caudal keel little developed. Dorsal falcate, its anterior lobe $1\frac{2}{5}$ in head, $2\frac{1}{3}$ in base of fin. Head $3\frac{4}{5}$; depth $3\frac{2}{5}$. D. VIII–I, 29; A. II–I, 21. Gulf of Mexico, north to Pensacola.

(Cuv. & Val. ix, 210; Günther, ii, 464: *Seriola bonariensis* Goode & Bean, Proc. U. S. Nat. Mus. ii, 1879, 129, not of C. & V.? It is thought by Dr. Lütken that this species is identical with *S. rivoliana*, but this identity is not yet proven. *S. rivoliana*=*bonariensis*=*bosci* seems to be slenderer, with a distinct black temporal band.)

Page 445. Instead of *Seriola stearnsi* read:

703. S. carolinensis Holbr.

This species differs from *Seriola dorsalis* notably in the larger mouth (maxillary reaching middle of eye, $2\frac{1}{6}$ in head, in *S. carolinensis;* barely reaching front of pupil, $2\frac{2}{3}$ in head, in *S. dorsalis*). *S. carolinensis*, *S. lalandi*, and *S. dorsalis* have the occipital region broadly rounded in the adult, while in *S. zonata* it is sharply compressed or carinated at all ages. In *S. zonata*, the body is much deeper, the head more obtuse, and the dark bands in the young fish much blacker.

(*Seriola carolinensis* and *S. zonata* Holbrook Ichth. S. Car. 1860, 72; *Seriola stearnsi* Goode & Bean.)

Page 446. According to Dr. Lütken (*Spolia Atlantica*, 1880, 603) *Elagatis pinnulatus* Poey (the "Runner") is identical with *Elagatis bipinnulatus* (Q. & G.) Benn., a species known from the East Indies and the Mediterranean. References for the latter are:

(*Seriola bipinnulata* Quoy & Gaimard, Voy. Uran. Zoöl. i, 363: *Elagatis bipinnulatus* Benn. Whaling Voyage, ii, 283: *Seriolichthys bipinnulatus* Bleeker, Nat. Tyds. Nederl. Ind. vi, 196: *Seriolichthys bipinnulatus* Günther, ii, 468; the generic name *Elagatis* being rejected by Dr. Günther on account of the prior *Elacate.*)

Page 447. In the typical species of *Scombroides* the maxillary has a small supplemental bone, of which no trace exists in the American species or "*Oligoplites.*" The latter group probably merits recognition as

a distinct genus. In very young specimens of *O. occidentalis* the upper jaw is protractile as usual in *Carangidæ*.

Page 448. Instead of *Pomatomus saltator* read:

708. P. saltatrix (L.) Gill.

"*Saltatrix*," as used by Linnæus, was an old proper name.

Page 451. Instead of *Stromateus alepidotus* read:

710. S. paru L.

In the description (p. 451) read pectoral much *longer* than head, and add to the synonymy:

(*Stromateus paru* L. Syst. Nat. ed. ii, 248; based on a figure and description in Sloane's "Jamaica"): *Seserinus xanthurus* Quoy & Gaim. Voy. Freyc. Zoöl. 384: *Rhombus xanthurus* C. & V. ix, 405; not *Stromateus paru* Bloch.)

Page 452. The genus "*Mupus*" Cocco (Su alcuni nuovi Pesci del Mar di Messina, in Giorn. Scienz. Lett. Arti per la Sicilia, xxvi, No. 77) is, according to Dr. Giglioli (*in lit.*), probably identical with *Lirus; Mupus imperialis* Cocco being thought to be the same as *Lirus ovalis*. As there is some uncertainty, it is probably best, however, not to adopt the name *Mupus*.

Page 454. Instead of *Coryphæna punctulata* read:

715. C. equisetis L.—*Small Dolphin.*

Bluish above, paler below, and yellowish; sides immaculate, or sprinkled with small, irregular blue spots; larger spots along base of dorsal; dorsal dark blue, usually marked with wavy lines or rows of spots; anal without spots. Profile of snout not becoming vertical with age; ventrals moderate, inserted somewhat behind the pectorals. D. 51 to 56; A. 24 to 26. Length 2½ feet. Pelagic; not rare on our South Atlantic and Gulf coast.

(L. Syst. Nat.; Günther, ii, 407; Lütken, Spolia Atlantica, 1880, 483: *Lampugus punctulatus* C. & V. ix, 327, *Coryphæna punctulata* Günther, ii, 408: *Coryphæna immaculata* Poey, Mem. Cuba, ii, 245; Lowe, Fishes Madeira, 67.)

Page 455. Instead of *Coryphæna sueuri* read:

716. C. hippurus L.—*Great Dolphin.*

Colors brilliant in life, changing suddenly at death; brownish-olive above, white or golden below, with bright blue spots, the largest on the back and head, forming bands on the snout; dorsal purplish-blue, with paler oblique lines; other fins tinged with blue; caudal yellow; in spirits, pale with blackish spots on the lower parts. Maxillary reaching middle of eye; profile of snout becoming nearly vertical with age; front of anal

under middle of body. "Male with the front elevated, forming a crest, which projects a little beyond the upper jaw; female with blue spots along each side of the tail, regularly arranged." (*Poey.*) Head 5; depth 5. D. 58–64; A. 26–30. Length 6 feet. In all warm seas; common in the Gulf of Mexico.

(L. Syst. Nat.; Günther, ii, 405; Poey, Syn. Pisc. Cub. 356: *Coryphæna guttata* Poey, Mem. Cuba, ii, 245; Lütken, l. c. 483: *Coryphæna sueuri* C. & V. ix, 302.)

Page 455. After *Pteraclis carolinus* add:

236 (*b*).—**BRAMA** Bloch & Schneider.

(Bloch & Schneider, Systema Ichthyol. 1801, 99: type *Sparus raji* Bloch.)

Body compressed, more or less elevated, covered with rather small scales. Mouth very oblique, the lower jaw projecting; both jaws with an outer series of strong teeth; teeth on vomer and palatines deciduous. Dorsal and anal fins elongate, the former with 3 or 4, the latter with 2 or 3 spines; caudal deeply forked; ventrals thoracic, I, 5. Opercles entire; branchiostegals 7. No air bladder. Pelagic. (Latin *brama*, bream; the species having been called "*Brama marina*" by Ray.)

717 (*b*). **B. raji** (Bloch) Schn.

Coloration uniform. Eye at the middle of the head; pectorals reaching middle of anal. Greatest depth below middle of body, 3 in total length. D. III–31; A. II–27; scales 13–90–23. Pyloric cœca 5. Vertebræ 16 + 23. Atlantic coasts of Europe and Africa, straying to Grand Banks of Newfoundland (*Bean*), coast of Washington Territory (*Bean*), and Chili.

(*Sparus raji* Bloch, Ichth. taf. 273; Günther, ii, 408.)

Page 459. For *Holocentrus* read *Holocentrum*. The former is the original orthography, but it is not worth while to try to restore it.

Page 461. Under *Elassomatidæ*, the statements "no teeth on vomer" and "pseudobranchiæ none" are not quite correct. A specimen of *Elassoma zonatum* from Tombigbee River, 1½ inches long, thus much larger than the original types, shows the following characters:

A few weak teeth on vomer; front teeth of both jaws canine-like, directed forward; pseudobranchiæ somewhat glandular, covered by skin. Scales cycloid; no lateral line. Dorsal apparently emarginate. D. V, 9; A. III, 5; Lat. l. 38. Head speckled with black; fins with dark spots.

Page 468. Under *Chænobryttus gulosus* read: "Head $2\frac{1}{2}$; depth $2\frac{1}{5}$."

Page 482. Under *Lepomis holbrooki* read: "Head 3"; and under *Lepomis notatus* read: "D. X, 12."

Page 485. Instead of *Micropterus dolomieu*, read *M. dolomiei*. This personal name should have the genitive form.

Page 523. Under *Perca*, tenth line from bottom, add: "Lower limb of preopercle with strong antrorse teeth."

Page 525, tenth line, under *Stizostedium*, add: "Lower limb of preopercle with a few antrorse teeth."

Page 532. After *Polyprion oxygenius* add:

273 (*b*).—**BRACHYRHINUS** Gill.

(Gill, Proc. Acad. Nat. Sci. Phila. 1862, 236: type *Serranus creolus* C. & V.)

Body oblong-ovate, compressed; head short, the profile convex, the snout short and blunt; jaws and all the bones of the head covered with imbricated scales. Scales of body very small. Mouth rather small, oblique, the lower jaw projecting. No supplemental maxillary. Teeth as in *Serranus*, but the lateral teeth small, not canine-like. Preopercle evenly serrate. Dorsal spines 9, none of them produced in filaments; fins all low; caudal fin forked. Warm seas.

835 (*b*). **B. furcifer** (C. & V.) Poey.

Red or reddish, with three small violet spots on the side of the back and one on the tail; sides with oblique streaks; dorsal fin with a longitudinal blackish streak. Snout short, scarcely longer than the large eye; maxillary reaching to below middle of eye; preopercle finely and evenly serrate. Gill rakers slender. Dorsal spines low, nearly uniform, but longer than the soft rays; second anal spine rather longer than third; pectoral long and pointed, longer than head; caudal deeply forked. Head $3\frac{1}{2}$; depth $2\frac{1}{5}$. D. IX, 19; A. III, 9; scales 10–83–85. Tropical America, generally abundant both in the Atlantic and Pacific; recorded by Dekay from near New York. This record is doubtful, although the occurrence of the species within our limits is very probable.

(*Serranus furcifer* and *creolus* Cuv. & Val., ii, 264, 265, 1828: *Brachyrhinus creolus* Gill, Proc. Acad. Nat. Sci. Phila. 1862, 249: *Brachyrhinus creolus* Poey, Ann. Lyc. Nat. Hist. N. Y. 1871, 46: *Corvina oxyptera* Dekay, N. Y. Fauna Fish. 1842, 77: *Anthias furcifer* Gthr. i, 91: *Serranus creolus* and *colonus* Gthr. i, 100, 101.)

Page 533. After *Serranus atrarius* add:

836 (*b*). **S. nigrescens** (Bloch & Schn.) Goode & Bean.

According to Dr. Holbrook the northern representative (*nigrescens*) of *Serranus atrarius* has the air-bladder simple, and the pectoral as long as the ventral; while in the southern form (*atrarius*) the air-bladder is sacculated, and the pectoral longer than the ventral. These observations are confirmed by Dr. Bean, who has also noticed other points of difference. The northern form (Cape Hatteras northward) may then stand as *S. nigrescens*.

(*Coryphæna nigrescens* Bloch & Schneider, 1801, 297: *Centropristis nigricans* C. & V. iii, 37, and of various authors.)

Page 534. In *Serranus trifurcus* the filamentous tips to the dorsal spines are often but little developed. A species, apparently the same, occurs in the Gulf of Mexico. Head $2\frac{2}{3}$; depth $3\frac{2}{3}$. D. X, 12; A. III, 7; scales 6–48–13. The section called "*Haliperca*" should be *Prionodes** Jenyns.

Page 535. To the account of *Serranus subligarius* add:

A large blotch of cream-color with sharply defined edges in front of vent, extending upwards as an irregular cross-band to near middle of sides; an interrupted black ring around tail at base of caudal; a large black blotch on front of soft dorsal; lower parts of head with a very conspicuous network of bluish streaks; pectorals, anal, and caudal, sharply barred with black; ventrals tipped with black. Body deep, compressed; the head very slender, acuminate, the anterior profile straight or somewhat concave; depth at middle of eye little more than half-length of head; lower jaw little projecting; maxillary reaching posterior margin of pupil, $2\frac{1}{6}$ in head; canines small, those on sides of lower jaw largest; edge of preopercle sharply and subequally serrate; gill-rakers short. Dorsal little emarginate, the fourth spine 3 in head; caudal subtruncate; second anal spine longer than third, $2\frac{1}{6}$ in head; jaws, and dorsal and anal fins scaleless. Head $2\frac{1}{2}$; depth 3; D. X, 13; A. III, 7; scales 6–42–17.

Pages 536, 537, etc. All the species of *Serranus* have normally 10 spines in the dorsal.

Page 536. Instead of subgenus *Plectropoma* substitute:

274 (*b*).—**HYPOPLECTRUS** Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1862, 236: type *Plectropoma puella*, C. & V.)

This genus differs from *Serranus* chiefly in the presence of antrorse

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* *Prionodes* Jenyns, Zoöl. Beagle. Fish. 1842, 46: type *Prionodes fasciatus* Jenyns.

spines on the lower margin of the preopercle. The species are of small size; the body short and compressed. ($\delta\pi\omega$, below; $\pi\lambda\tilde{\eta}\kappa\tau\rho o\nu$, spur.)

Page 537. Instead of *Serranus chlorurus* read:

843. H. nigricans (Poey) Gill.

The species found on the Florida coast has the body and fins all alike blackish, with violet shades, and is doubtless distinct from *H. chlorurus*, in which the pectorals and caudal are yellow. Florida to Cuba.

Page 538. Instead of *Trisotropis brunneus* read:

844. T. stomias Goode & Bean MSS.

The color in this species, the "Black Grouper" of the Florida coast, is dark gray, freckled with paler, but without distinct spots; fins all edged or tipped with black; no yellow nor violet shades anywhere. Caudal lunate. Mouth very large; the maxillary longer than pectoral. The identification of this species with *T. brunneus* Poey is very doubtful.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

Page 539. After *Trisotropis microlepis* add:

846 (*b*). **T. petrosus** Poey.

Light brownish violet, covered with close-set round reddish brown spots about as large as the pupil, besides large quadrate dark areas on the trunk; no red anywhere. Fins dark brown, except the pectorals, which are black, with a broad border of bright orange, at least in the adult. Maxillary extending beyond orbit. Preopercle rounded, finely serrate. Caudal lunate, the lower angle rounded. Head $3\frac{1}{6}$ (in total); depth 4. D. XI, $16\frac{1}{2}$; A. III, 11; cœca 15 to 20. Cuba to Key West. (*Poey.*)

(*Serranus petrosus* Poey, Memorias, ii, 136: *Trisotropis petrosus* Poey, Ann. Lyc. Nat. Hist. N. Y. ix, 301, 1870.)

Page 540. "*Epinephelus capreolus*" should apparently stand as—

847. E. atlanticus (Lac.) J. & G.

The earlier names, *Holocentrus punctatus* Bloch (Ichth. taf. 241) and *Perca maculata* Bloch are both preoccupied in this genus.

Page 541. After *Epinephelus nigritus* add:

850 (*b*). **E. striatus** (Bloch) Gill.—*Hamlet; Nassau Grouper.*

Chestnut-brown, varying to light slate-color; lips and throat vermillion; a black stripe sometimes present, extending from snout to a point between eyes, then dividing, one branch extending to origin of dorsal, the other to opercle; a large quadrate black blotch on tail behind dorsal;

young with transverse dark bars; ventrals dusky. Body rather deep, somewhat compressed. Mouth large, the maxillary extending beyond eye, 2 in head; canines rather strong. Preopercle nearly evenly serrate. Caudal rounded*; second anal spine rather strong, slightly longer than third; dorsal spines rather high. Jaws and fins with fine scales. Head $2\frac{1}{2}$; depth $2\frac{1}{2}$. D. XI, 17; A. III, 8; Lat. l. about 85. West Indies; north to Key West (*Poey; Stearns*); very abundant; reaches the length of 4 or 5 feet.

(*Anthias striatus* Bloch, Ichth. ix, 103, 1797: *Serranus striatus* Günther, i, 110: Goode, Bull. U. S. Nat. Mus. v, 57: Poey, Rep. Fis. Nat. Cuba, ii, 285.)

Page 541. The group called *Bodianus* is probably entitled to generic rank. Its species should stand as follows:

852. B. punctatus (L.) J. & G.

852 (*b*). **B. tæniops** (C. & V.) J. & G.

Red or dark brown, the head, body, and fins covered with small round blue, black-edged spots; one or two dark-blue streaks from eye to snout; fins all more or less edged with deep blue. Maxillary reaching posterior margin of eye; canine teeth rather strong, the upper largest. Caudal rounded behind; no notch between dorsal spines and soft rays. Second and third anal spines about equal. Head $2\frac{1}{2}$; depth $2\frac{4}{5}$. D. IX, 15; A. III, 9; Lat. l. 100. Tropical Atlantic; Florida Keys to Senegambia. (*Steindachner.*)

(*Serranus tæniops* C. & V. ii, 370: *Serranus tæniops* Günther, i, 121: *Serranus tæniops* Steindachner, Beiträge Kenntn. Fische Afrika's, 1881, 4.)

852 (*c*). **E. guttatus** (Gmelin) Goode.—*Cabrilla.*

Olivaceous; body and head everywhere covered with small bronze spots, much smaller than the pupil, the spots mostly with darker centers; besides these are larger obscure pale spots, around which the ground color forms reticulations; whitish marblings on sides of back; base of pectoral reticulate; vertical fins obscurely spotted; the soft dorsal and caudal broadly margined with black; pectorals pale; ventrals dusky at tip. Body comparatively elongate. Mouth large, the maxillary extending past the eye, its length $2\frac{1}{3}$ in head. Eye shorter than snout, $5\frac{1}{2}$ in head. Depressible teeth in front of jaws long. Fins of moderate height; caudal truncate; anal spines moderate, the second about as long as third, 5 in head; pectoral $1\frac{3}{5}$ in head. Head $2\frac{1}{2}$; depth

*The caudal is lunate in *E. morio* and in the species of *Trisotropis*. In our other species of *Epinephelus* it is rounded or truncate.

3. D. XI, 15; A. III, 8; Lat. l. about 100. West Indies, north to Florida Keys.

(*Perca guttata* Gmel. Linn. Syst. Nat. i, 1788, 1315: Goode, Bull. v, U. S. Nat. Mus. 1876, 58; *Bodianus apua* Bloch, taf. 229: *Serranus apua* Günther, i, 140: *Holocentrus punctatus* Bloch, taf. 241: *Lutjanus lunulatus* Bloch & Schneider, 1801, 329: *Serranus catus*, *lunulatus*, *arara*, and *pixanga* C. & V. ii, 362, 379, 377, 383: *Epinephelus lunulatus* Poey, Syn. Pisc. Cubens. 1868, 287: *Serranus apua* Steindacher, Ichth. Notiz. vi, 43, 1867.)

Page 541. *Promicrops* should be reunited with *Epinephelus*. Our species may stand as:

853. E. guasa (Poey) J. & G.

It is however probable, as suggested by Dr. Gill, that the *Epinephelus guasa* is simply the very old form of *E. nigritus*, also known as "*Guasa*" or "*Warsaw*" by the Florida fishermen.

Page 542. *Dules auriga* should be omitted, as it has probably never been taken on our coast.

Page 543. Instead of *Rhypticus decoratus* read:

856. R. nigripinnis Gill.

And add to the synonymy:

(*Rhypticus nigripinnis* Gill, Proc. Acad. Nat. Sci. Phila. 1861, 53: ? *Promicropterus decoratus* Cope, Proc. Acad. Nat. Sci. Phila. 1870, 110.)

This species inhabits the Pacific coast of Mexico and Central America, and we doubt its occurrence on our Atlantic coast. The specimens obtained by Professor Cope at Newport may belong to some different species.*

Page 546. Instead of *Xenichthys* Gill read:

281.—XENISTIUS Jordan & Gilbert (gen. nov.).

In the typical species of *Xenichthys* Gill, the soft dorsal is much longer than the spinous dorsal, and composed of 18 rays; the anal is also similarly elongate, of 16 to 18 rays. In *X. californiensis*, the soft dorsal is shorter than the spinous dorsal, and composed of 11 or 12 rays; the anal is also short. The latter species may be taken as the type of a distinct genus, which may be called *Xenistius*. (ξενος, peculiar; ἱστιον, sail, for dorsal fin.)

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* Professor Cope describes the specimen from Newport as follows: "D. II, 26; A. 16; scales 11–98–46, counted from base of second dorsal spine. Dorsal fins connected by membrane as elevated as that of the first dorsal. Head (from premaxilla to end of spine) more than 4 times in length, including caudal fin. Pectorals not narrowed. Eye 5.33 times in length of head. Otherwise, as in *P. maculatus* Holbr. Color dark brown, covered with round pale spots as large as the orbit, each with a brown central spot. They extend on the dorsal and proximal caudal fins. Second dorsal, anal, and caudal fin broadly blackish-edged."

Page 548. Instead of *Lutjanus melanurus* read:

861. L. chrysurus (Bloch) Vaillant.

Erase from its synonymy "*Perca melanura* L. Syst. Nat." The latter is a West Indian species of *Diabasis* (=*Hæmulon dorsale* Poey).

Page 548, 549. In all our species of *Lutjanus* the series of scales above the lateral line extend obliquely upward and backward, being not throughout parallel with it. In *L. chrysurus*, *caxis*, *stearnsi*, and *blackfordi*, the patch of vomerine teeth is "anchor-shaped." In many of the other species of the genus the patch of vomerine teeth is lunate, and in some the series of scales above the lateral line are parallel with the lateral line.

Page 549. After *Lutjanus caxis* add:

862 (*b*). **L. caballerote** (Bloch & Schneider) Poey.

Brown, tinged with violet; red below; fins wine color; eye red; young with a blue stripe or line of points under the eye, but without dark bands. Body rather more elongate than in *L. caxis;* snout prominent, 3 in head, the profile somewhat concave; mouth rather small; maxillary not reaching middle of orbit; jaws subequal; teeth very strong; upper jaw with 2 large and 4 small canines; vomerine teeth prolonged backward on the median line; eye $4\frac{1}{2}$ in head, $1\frac{2}{3}$ in snout; preopercle notched, but the knob of the interopercle very inconspicuous; caudal emarginate; pectorals $1\frac{3}{5}$ in head, scarcely reaching front of anal; second anal spine strong, scarcely longer than third; fourth dorsal spine longest. Direction of rows of scales above lateral line very oblique; nuchal scales in 3 series. Head $2\frac{2}{3}$; depth 3. D. X, 13; A. III, 7; scales 9–45–16. West Indies, north to Key West. Reaches a weight of 12 pounds.

(*Anthias caballerote* Bloch & Schneider, Syst. Ichth. 1801, 310: *Mesoprion cynodon* Günther, i, 194; Poey, Proc. Acad. Nat. Sci. Phila. 1860, 187; Poey, Synops. Pisc. Cub. 1868, 293; Poey, Ann. Lyc. Nat. Hist. N. Y. x, 75, 1871.)

862 (*c*). **L. campechianus** Poey.

Deep red, paler on the throat; streaks along the rows of scales bluish above, yellowish on the sides; fins colored like the body; dorsal bordered with orange, and with a narrow blackish edge; caudal bordered with blackish; eye red; a blackish blotch near the lateral line below soft dorsal, as in numerous West Indian species (and in the young of *L. blackfordi*). Body rather deep. Eye large, 4 in head; maxillary reaching front of eye; preopercle serrate, the concavity slight; interopercle without knob; canines slender; teeth in lower jaw large in

front; tongue with two rough plates; soft dorsal as long as the part of the spinous behind fifth spine; caudal little forked. Temporal band of scales broad; scales above lateral line forming oblique series not parallel with the back. Vomerine teeth prolonged backward in a long band on the median line. D. X, 14; A. III, 8; 65 scales in a series above lateral line, 53 below. Gulf of Mexico; brought to the Havana markets from the Bay of Campeachy and from Key West. (*Poey.*)

(*Mesoprion campechanus* Poey, Memorias Cuba ii, 149, 1860, and in Synops. Pisc. Cubens, 294: *Mesoprion campechianus* Poey, Ann. Lyc. Nat. Hist. N. Y. 1870, 5.)

Page 549. To the account of *Lutjanus stearnsi* add: Scales above lateral line forming oblique series, which are not parallel throughout with the lateral line. Teeth on vomer in an anchor-shaped patch, prolonged backward on the median line; outer pair of canines above, very large; teeth of lower jaw moderate; teeth on tongue in a single patch; maxillary $2\frac{3}{4}$ in head, reaching front of pupil; posterior nostril ovate; pectoral $1\frac{1}{2}$ in head; second and third anal spines subequal.

Page 549. After *Lutjanus stearnsi* add:

864 (*b*). **L. synagris** (L.) Poey.

Olivaceous above, silvery on sides and below; flushed with reddish above; back and sides with wide, continuous stripes of golden yellow, usually wider than a series of scales; a black blotch below soft dorsal; sides of head with yellow stripes usually continuous with those on sides; two yellow stripes from eye to snout; caudal red; other fins yellowish; dorsal with two reddish longitudinal bands; ventrals margined with white; these colors fading in alcohol. Body rather deep and compressed; anterior profile steep and nearly straight; lower jaw projecting; maxillary reaching to below front of eye. Teeth rather small, subequal, the canines little developed; teeth on vomer in a ⩚-shaped patch, slightly prolonged backward on the median line. Scales small, smoothish; those above lateral line arranged in series not parallel with the lateral line. Preopercle with a shallow notch. Dorsal spines slender; anal spines graduated; anal fin rather high; caudal moderately forked. Pectorals long, $1\frac{1}{4}$ in head, almost reaching anal. Gill-rakers rather long and strong. Head $2\frac{2}{3}$; depth $2\frac{2}{3}$. D. X, 12; A. III, 7; scales 6–50–17. L. 12 inches. West Indies; north to Key West, Florida.

(*Sparus synagris* L. Syst. Nat.: *Sparus vermicularis* Bloch & Schneider, 1801, 275: *Mesoprion uninotatus* Cuv. & Val. ii, 479: *Mesoprion uninotatus* Günther, i, 202: *Mesoprion uninotatus* Poey, Synopsis Pisc. Cubens, 294.)

Page 550. *Conodon* C. & V. should be recognized as a distinct genus.

Page 550. To the account of *Conodon nobilis* add:

Series of scales above lateral line, forming series parallel with the lateral line; anterior limb of preopercle with strong spinous teeth directed forwards. In all our species of *Pomadasys* the scales above the lateral line form series not parallel with the lateral line.

Page 551. *Pomadasys fasciatus* is identical with *P. fulvomaculatus* and should be suppressed. Instead of "Lat. l. 75," in the description of the latter species, read "Lat. l. 57."

Page 551. After *bb*, etc., add:

c. Body short and deep; the back arched; spines strong; outer teeth enlarged; lips thick; soft dorsal and anal with small scales. (*Anisotremus* Gill.)

Page 552. In the description of *P. virginicus* add "scales 10–55–16."

Page 552. *Pomadasys bilineatus* has been lately taken in Florida by Dr. J. A. Henshall. Scales 6–35–13; about 45 pores in lat. l. The specimens from California referred to this species probably belong to the following:

871 (*b*). **P. interruptus** (Gill) J. & G.

Adult grayish; each scale on upper anterior part of body with a distinct blackish spot; fins all more or less dusky. Young (?) (*interruptus*) with the spots obsolete; sides with two parallel jet-black bands, the lower from eye backward nearly but not quite reaching a large black blotch at base of caudal. Back arched; pectoral a little shorter than head; second anal spine robust, half length of head, longer than fourth dorsal spine. Scales very large, especially below spinous dorsal, where they are much larger than in *P. bilineatus*. Head 3; depth 2½. D. XII, 16; A. III, 9; scales 7–34–12; pores about 45. San Diego (?) to Panama.

(? *Genytremus interruptus* Gill, Proc. Ac. Nat. Sci. Phila. 1861, 256 (young): *Pristipoma fürthi* Steind. Ichth. Beitr. v, 4, 1876: *Pomadasys fürthi* Jor. & Gilb. Proc. U. S. Nat. Mus. 1881, 385.)

Page 553. After *Diabasis formosus* add:

872 (*b*). **D. elegans** (C. & V.) J. & G.

Brownish; sides of head *and body* with seven or eight conspicuous wavy longitudinal bands of light blue, edged with dusky. Back somewhat elevated; snout long, compressed; mouth large, the maxillary reaching to below eye; eye 1½ in snout, 3½ in body. Head 3⅓ (in total); depth about the same. D. XII, 16; A. II, 9; scales 8–50–16. West

Indies; north to Florida. Resembles *D. formosus*, but readily distinguished by the striped body.

(*Hæmulon elegans* C. & V. v, 227: *Hæmulon elegans* Günther, i, 306.)

Page 553. After *Diabasis chrysopterus* add:

873 (*b*). **D. chromis** (Brouss.) J. & G.

Light olive; each scale with a large dark spot; these forming very distinct interrupted stripes along the rows of scale; lower fins dusky; a dusky blotch at angle of preopercle. Young with 2 or 3 longitudinal blackish streaks. Back somewhat elevated; maxillary reaching just past front of eye, $2\frac{2}{3}$ in head. Series of scales above lateral line very oblique (as in all our species of *Diabasis*), the series from the scapular scale reaching 6th dorsal spine; preopercle well serrated. Longest dorsal spine $2\frac{1}{2}$ in head; second anal spine strong, $2\frac{1}{3}$ in head, the fin high. Pectoral $1\frac{1}{3}$ in head. Head 3; depth $2\frac{3}{5}$. D. XII, 18; A. III, 7; Lat. l. 42. West Indies; north to Florida.

(*Perca chromis* Broussonet MSS: *Hæmulon chromis* C. & V. 242: *Hæmulon chromis* Günther, i, 310: *Hæmulon serratum* Poey, Memorias, ii, 181.)

873 (*c*). **D. albus** (C. & V.) J. & G.

Color pale uniform plumbeous; no black spot behind angle of preopercle. Mouth wide, but the maxillary not reaching front of orbit; eye 6 in head, $2\frac{2}{3}$ in snout; preopercle finely and evenly serrate, its posterior limb nearly vertical. Dorsal fin scarcely notched, the spines rather strong, the fourth longest, $2\frac{1}{3}$ in head; second and third anal spines nearly equal in length and strength, rather more than half fourth dorsal spine. Caudal forked. Head $3\frac{1}{2}$ (in total); depth $3\frac{1}{4}$. D. XII, 16; A. III, 8; scales 7–50–16. West Indies; north to Key West. (*Poey.*)

(*Hæmulon album* Cuv. & Val. v, 241: *Hæmulon album* Günther, i, 311: *Hæmulon album* Poey, Synopsis Pisc. Cubens. 1868, 312.)

Page 553. To description of *Diabasis chrysopterus* add:

Brownish-olive above; a narrow bronze band, darkest in young, from snout, through eye, to base of caudal; above this two or three dark streaks from eye to above gill-opening; another beginning on top of snout on each side, passing above eye, and extending parallel with the first-mentioned stripe straight to last ray of dorsal, where it meets its fellow of the opposite side; a dark streak from tip of snout along me-

dian line to front of anal; very bright specimens show a narrow yellow stripe following each series of scales on back and sides; adults often plain silvery; a large rounded black blotch at base of the caudal; fins all plain; inside of mouth scarlet. Body rather elongate, somewhat compressed; the back little elevated. Snout rather short, $2\frac{3}{4}$ in head; preorbital moderate, about equaling eye. Maxillary reaching middle of pupil, 2 in head. Eye $4\frac{1}{3}$ in head. Dorsal spines rather high, the longest $1\frac{3}{4}$ to $2\frac{1}{4}$ in head, longer than the second anal spine; second anal spine strong, longer and stronger than third, $2\frac{2}{3}$ to $2\frac{4}{5}$ in head, reaching, when depressed, to base of last ray. Pectorals $1\frac{1}{4}$ to $1\frac{1}{2}$ in head. Head 3; depth 3. D. XIII, 15; A. III, 8; scales 7–52–13. The color of the young of *D. fremebundus* is very similar, but the back in the latter species is more arched, the mouth much smaller, and the scales below the lateral line much larger. The adult form of *D. fremebundus*, as yet unknown, is probably more like *D. chromis*. To synonomy of *D. chrysopterus* add:

(*Hæmulon aurolineatum* C. & V. v, 237: *Hæmulon aurolineatum* Gthr. i, 316: *Hæmulon caudimacula* Poey, Syn. Pisc. Cub. 379; not of C. & V.: *Hæmulon quadrilineatum* Holbrook, Ichth. S. C. 1860, 195.)

874 (*b*). **D. jeniguano** (Poey) Goode & Bean.

Pale olive, with faint dusky and yellow longitudinal streaks, especially in the young; fins all pale, probably yellow in life. Body comparatively elongate, compressed, the back little elevated, the profile regularly curved and not steep. Snout 3 in head; eye $3\frac{1}{2}$. Mouth very large, the maxillary extending slightly past middle of eye, $1\frac{4}{5}$ in head. Teeth not very large. Preopercle well serrated. Dorsal deeply notched, the spines moderate, the longest equal to maxillary; soft dorsal low; anal rather high, its edge concave, its second spine about as long as third and much stronger, $2\frac{1}{2}$ in head; caudal well forked, the upper lobe longest. Pectoral $1\frac{1}{3}$ in head, reaching past ventrals to vent. Scales above lateral line in very oblique series. Head 3; depth 3. D. XIII, 15; A. III, 9; scales 7–50–11. L. 7 inches. Cuba, north to Garden Key, Florida.

(*Hæmulon jeniguano* Poey, Memorias Cuba, ii, 183, 1860, and in Syn. Pisc. Cub. 319; ? *Hæmulon schranki* Agassiz, Spix. Pisc. Bras. 131: ? *Hæmulon schranki* Günther, i, 310.)

Page 556. Before *Sparus* insert:

285 (*b*).—**CALAMUS** Swainson.

(Swainson, Nat. Hist. Fish. etc. ii, 221, 1839: type *Pagellus calamus* C. & V.)

Body broadly ovate, compressed, the back elevated; head deep; preorbital very deep; eye placed high, preceded by a bluntish pro-

tuberance; posterior nostril slit-like, much larger than the roundish anterior nostril; opercles very short and deep; cheeks and opercles scaly, rest of head naked; mouth low, horizontal, rather small; both jaws with a band of cardiform teeth in front, the anterior series more or less enlarged, sometimes canine-like; sides of each jaw with 2 to 4 series of molars; gill-rakers small. Scales large. Dorsal continuous, rather low, its spines slender; a procumbent spine before the dorsal, concealed by scales in some of the species; caudal deeply forked; anal spines rather small; pectoral rather narrow, usually very long. *Second interspinal bone of the anal enlarged, pen-shaped*, the end of the air-bladder being received into its concave part. "The skull is extended downwards to the chevron of the vomer, and entire on each side behind the forehead; the parasphenoid has a deep but thin inferior crest, which is more or less notched in front of its posterior decurrent processes; the forehead comparatively narrow, ill-defined, depressed above the preorbital region, horizontally pitted; the occipital crest extending far forwards and thickened with vertical osseous deposits, the inner as well as the outer lateral crests depressed near the orbits." (*Gill, MSS.*) Species rather numerous, mostly of small size, chiefly of tropical America. (Latin *calamus*, a pen.)

876 (*b*). **C. megacephalus** Sw.—*Plume-fish*; *Pez de Pluma.*

Light olive, with bluish reflections, the young with dark cross-bars; front of head and preorbital region with horizontal anastomosing wavy lines of steel-blue, the interspaces yellowish; ventrals pale. Body compressed, the back arched, the anterior profile steep, not very convex; depth of preorbital half head; preocular prominence not very sharp; eye moderate, 4 in head. Cleft of mouth $3\frac{2}{3}$ in head. Anterior teeth of each jaw moderately enlarged, 6 to 8 in number; outermost tooth on each side of upper jaw much larger than the others, forming a *strong canine directed outward and forward.* A concealed procumbent spine before dorsal; dorsal of moderate height, the soft rays highest; caudal deeply forked, the upper lobe the longer; anal spines small, graduated; pectoral reaching front of anal, a little longer than head. Head $3\frac{1}{2}$; depth $2\frac{1}{3}$. D. XII, 12; A. III, 10; scales 6–55–16. West Indies, north to Florida.

(*Pagellus calamus* C. & V. vi, 206, 1830: *Calamus megacephalus* Swainson, Nat. Hist. Fish. ii, 222, 1839: *Chrysophrys calamus* Günther, i, 187; Poey, Ann. Lyc. Nat. Hist. N. Y. x, 178, 1872: *? Calamus pennatula* Guichenot, Révue des Pagels in Mem. Soc. Imp. Sci. Nat. Cherbourg, xiv, 112, 1868.)

876 (*c*). **C. bajonado** (Bloch & Schneider) Poey.

Bluish gray, with bright reflections; a blue stripe below eye; angle

of mouth orange; fins pale; young with 5 or 6 dark olive bars; caudal faintly barred. Body deep, the back considerably elevated; muzzle prolonged, the profile somewhat arched; eye large, $3\frac{2}{3}$ in head. Canine teeth rather long and strong, all similar, usually about 8 in each jaw outside of the cardiform band. Caudal deeply forked; anal spines graduated; pectoral long, somewhat longer than head, reaching past anal spines. Depth of preorbital $2\frac{1}{3}$ in head. Head $3\frac{1}{3}$; depth 2. D. XII, 12; A. III, 10. Tropical America, north to South Carolina and Lower California.

(*Sparus bajonado* Bloch & Schneider, Syst. Ichth. 1801, 284: *Pagellus caninus* Poey, Mem. Cuba, ii, 468, 1861: *Calamus bajonado* Poey, Ann. Lyc. Hist. N. Y. x, 176, 1872: *Sparus brachysomus* Lockington Proc. U. S. Nat. Mus. 1880, 283.)

876 (*d*). **C. macrops** Poey.

Pale olivaceous, somewhat silvery; sides with obscure olivaceous bands, especially in the young; preorbital not striped; ventrals pale. Body broad-ovate, compressed, the back elevated, the anterior profile slightly curved, not very steep. Preorbital deeper than long, its depth nearly half head. A sharp-edged bony prominence before eye. Eye large, 3 in head, about as long as maxillary. Front teeth slender, little enlarged, about 12 in the outer series in each jaw; molars rather small, in 3 rows above and 2 below. Scales above lateral line, in series parallel with the lateral line. Procumbent spine of dorsal concealed. Fins low; caudal moderately forked. Pectoral long, a little longer than head, reaching second anal spine, which is little enlarged, little longer than third. Head $3\frac{1}{3}$; depth $2\frac{1}{10}$. D. XII, 12; A. III, 11; scales 7–53–17. Cuba, north to Garden Key, Florida.

(*Calamus macrops* Poey, Ann. Lyc. Nat. Hist. N. Y. x, 181, 1872.)

876 (*e*). **C. arctifrons** Goode & Bean.

Light olive, with bright reflections; sides with obscure dark cross-bars; head without distinct markings; fins nearly plain, all pale. Body oblong-ovate, more elongate than usual in this genus, the anterior profile being very convex. Mouth rather large; maxillary $2\frac{1}{6}$ in head, reaching front of orbit. Front teeth in both jaws rather strong, all similar, somewhat canine-like, 6 to 8 in each jaw; upper molars in 2 rows anteriorly and 3 posteriorly; lower in 2 rows; a conspicuous pore with a dermal flap on each side of snout. Preorbital very deep, its depth $3\frac{1}{3}$ in head. Eye small, $3\frac{3}{4}$ in head, placed very high. Dorsal spines slender, the longest $3\frac{2}{5}$ in head, about equal to longest soft ray. Anal spines small, graduated, the third 4 in head. Caudal deeply

forked, the upper lobe nearly as long as head. Pectorals as long as head, reaching slightly past vent. Head $3\frac{1}{5}$; depth $2\frac{1}{3}$. D. XIII, 12; A. III, 11; P. 16; scales 5–46–14. Southern Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882.)

bb. Anterior teeth little larger than the others, not canine-like. (*Grammateus* Poey.)

876 (*f*). **C. medius** (Poey) J. & G.

Olivaceous, rather dusky; body and vertical fins with obscure bars of dark olive, which mostly disappear with age; preorbital with narrow, horizontal bluish stripes; ventrals pale. Body rather elongate, comparatively elliptical; the back less arched than in other species; the anterior profile moderately curved. Preorbital deep, $2\frac{1}{3}$ in head; maxillary $2\frac{1}{3}$ in head. Eye small, placed high, 4 in head. Anterior teeth small, scarcely enlarged, none of them canine-like; molars mostly in three series above, two below. Spines low, slender; soft dorsal low; caudal less deeply forked than usual; anal spines graduated; pectoral comparatively short, as long as head, reaching a little past vent. Distance from base of pectoral to base of dorsal less than head. Head $3\frac{1}{4}$; depth $2\frac{2}{5}$. D. XII, 12; A. III, 9; scales 5–46–11, 16 in a series between dorsal and nape. L. 10 inches. Florida to Cuba.

(*Grammateus medius* Poey, Ann. Lyc. Nat. Hist. N. Y. 1872, 183.)

877. C. milneri (G. & B.) J. & G.

This species belongs to the genus *Calamus*, and is very closely allied to *C. medius*, from which it may be distinguished by the following characters: No blue stripes on preorbital; ventrals blackish. Back more arched than in *medius*, the anterior profile less convex; distance from axil of pectoral to front of dorsal greater than length of head. Eye 4 in head (not 5 as in *C. microps* Guichenot a Cuban species, with which it agrees in other respects). Scales above lateral line smaller. Scales 6–47–13; about 26 in a series before dorsal. Head $3\frac{2}{5}$; depth $2\frac{1}{5}$.

Page 556. **Sparus pagrus** L.—*Gulf Porgee.*

The coloration of this species as shown in specimens from Pensacola is as follows: Light crimson, shaded with golden olive; sides and below silvery, flushed with red; many scales of back and sides each with a small round spot of deep purplish blue, these forming longitudinal streaks below and broken oblique streaks above lateral line; a few blue spots on nape and opercle; fins largely orange, shaded with pink. We find no account of the presence of blue spots in the European variety of this species.

Page 557. The groups called *Stenotomus* and *Lagodon* should be recognized as genera distinct from *Diplodus*, and the prior *Argyrops** Sw. (Class'n Fish, etc., 1839, 221; type *Sparus spinifer* Forsk.) should probably be used for the former.

Page 557. The species called in the text *Sparus chrysops* and *Sparus aculeatus* are identical. The species belongs to the genus *Argyrops*, and should stand as:

880. A. chrysops (L.) J. & G.—*Southern Porgee.*

Differing from the common northern scup, *A. versicolor*† (Mitch.) J. & G. (=*S. argyrops* Auct. not of Linn.), in the following respects:

Body more elongate and less elevated anteriorly; molar teeth coarser; size larger. Head $3\frac{1}{3}$; depth $2\frac{1}{2}$. D. XII, 12; A. III, 11; scales 7–48–14. L. 18 inches. Cape Cod to Florida. The specimen described in the text (25170 U. S. Nat. Mus.) is unusually deep-bodied for this species.

Page 557. After *Argyrops versicolor* add:

881 (*b*). **A. caprinus** (Bean) J. & G.—*Goat's Head Porgee.*

Light olive; silvery below; the young with faint very narrow darker bars. Body subovate, the back anteriorly much more elevated than in

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*The cranial characters of *Argyrops* are very different from those of *Diplodus*, as is shown by the following account of the skulls of the two genera, kindly furnished to us by Professor Gill:

In *Diplodus* "the skull is extended downwards to the chevron of the vomer, and is notched on each side behind the forehead; the parasphenoid has a varying inferior crest, which is entire near its posterior decurrent processes; forehead broad, well defined, convex transversely above the orbits, abruptly terminated behind by the convergence of the external lateral crests into the occipital, the occipital crest ending abruptly behind the forehead, and thickened with vertical osseous striæ; the inner as well as outer lateral crests erect and laminar, and converging more or less forwards.

"In *Diplodus* proper the forehead is moderately broad and the bones contracted forwards, the parasphenoid with a superficial inferior crest, convex forwards, and little developed posterior decurrent processes.

"In *Archosargus* Gill, the forehead is very broad and the bones wide and almost even with the prefrontals in front; the parasphenoid with a deep inferior crest, and emarginated anteriorly and with enlarged posterior decurrent processes.

"In the genus *Stenotomus* (*Argyrops*) the skull is extended forwards to the head of the vomer and notched on each side behind the forehead; the parasphenoid has the inferior crest low, and little developed posteriorly-decurrent processes; the forehead is narrow and ill-defined behind, its surface of compact texture, but with a few foramina and two longitudinal grooves on each side; the occipital crest moderate, extending but little forward of the supraoccipital bone, and not overhanging backward; the crest strengthened by a longitudinal lateral ridge on each side, terminating backwards in mamilliform projections, the inner and outer lateral crests not procurrent on the forehead."

† *Labrus versicolor* Mitch., Trans. Lit. and Phil. Soc., 1815, 1, 404. *Sparus argyrops* L. is the young of *A. chrysops*, with 2d and 3d dorsal spines filamentous.

versicolor. Profile steep, with a strong depression above eye; the snout rather pointed; occipital region carinate. Front teeth small, in a close-set band, the outer series a little enlarged, compressed and lanceolate, much as in *versicolor*. Molars in two rows in each jaw. Gill-rakers very short. A strong procumbent spine before dorsal; first and second dorsal spines very short; third dorsal spine more or less filamentous, reaching past middle of soft dorsal; pectoral a little longer than head, reaching soft rays of anal. Scaly part of cheek as deep as long (in *A. versicolor* considerably longer than deep). Second interspinal of anal quill-shaped as in *Calamus*. Head $3\frac{3}{8}$; depth 2. D. XII, 12; A. III, 12; scales about 7–48–14. West coast of Florida, in rather deep water. Distinguished from *A. versicolor* by the deeper cheek and preorbital, the different form of the body, and the difference in the dorsal spines.

(*Stenotomus caprinus* Bean, Proc. U. S. Nat. Mus. 1882.)

On page 560, after *Diplodus caudimacula*, add:

885 (*b*). **D. caribæus** (Poey) J. & G.—*Sargo*.

Steel-brown, with golden-yellow longitudinal stripes, which scarcely extend on the head, 3 above, 5 or 6 below the lateral line; a black spot at the shoulder; dorsal yellowish, with a faint dusky median stripe; ventrals orange in the females, yellowish and punctate in the males; anal similarly colored. Body deep; snout obtuse; maxillary reaching beyond posterior nostril; molars in two rows; incisors broad, entire; second anal spine much longer and larger than third; pectoral long and pointed; caudal forked. Head $4\frac{1}{5}$ (in total); depth $2\frac{3}{4}$. D. XIII, 11; A. III, 10. West Indies, north to Key West (*Poey in lit.*).

(*Sargus caribæus* Poey, Memorias, ii, 1860, 197, and in Synops. Pisc. Cubens. 309.)

Page 563. After *Apogon americanus* add:

889 (*b*). **A. maculatus** (Poey) J. & G.

Uniform bright scarlet; a round black spot below second dorsal and another on side of caudal peduncle above median line. Maxillary 2 in head, reaching beyond pupil; eye very large, 3 in head; preopercle distinctly serrulate; pectoral $1\frac{1}{2}$ in head, a little shorter than caudal. Head $2\frac{1}{4}$; depth $2\frac{4}{5}$. D. VI–I, 7; A. II, 8; scales $2\frac{1}{2}$–26–7. L. 3 inches. West Florida to Cuba.

(*Monoprion maculatus* Poey, Mem. Cuba ii, 123, 1860: *Amia maculata* Poey, Syn. Pisc. Cub. 304, 1868; Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 279.)

It is doubtful whether *Apogon americanus* has ever been really taken

on our coast, or indeed what that species may be. The original type, in bad condition, has been identified by Vaillant & Bocourt with *Apogon dovii*, a Panama species, and their description, copied in the text on page 563, seems to have been drawn from the latter species.

a. Preopercle entire; scales large. (*Apogonichthys* Bleeker.)

889 (*c*). **A. alutus** J. & G.

Rusty-red, with silvery luster, body and fins very finely speckled with dusky; vertical fins somewhat yellow, their tips dusky with dark points. Mouth very oblique; maxillary $1\frac{1}{4}$ in head, reaching past pupil; preopercle with both ridges entire; eye moderate, $2\frac{4}{5}$ in head; second anal spine half length of longest anal ray, $3\frac{1}{2}$ in head; ventrals a little longer than pectorals, not reaching vent. Head $2\frac{3}{4}$; depth $2\frac{3}{4}$. D. VI–I, 9; A. II, 8; Lat. l. 21. L. $2\frac{1}{2}$ inches. West Florida.

(?? *Apogonichthys puncticulatus* Poey, Repert. Fis. Nat. Isl. Cuba, ii, 233 (lat. l. 30); Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 279.)

Page 564. **Mullus barbatus** L.

Specimens of this species have been obtained at Pensacola, Florida, and at Wood's Holl, Massachusetts. The American form (subsp. *auratus* J. & G.) is distinguishable from the typical *barbatus* in the lower fins, less blunt snout, shorter mouth, and the presence of two lateral stripes of yellow. From the European variety *surmuletus* (*Mullus surmuletus* L.), subsp. *auratus* is known by the lower fins and by the replacement of the black band on the dorsal fin by a band of yellow. Head $3\frac{2}{5}$; depth 4. D. VII–I, 8; A. II, 6. Palatine teeth coarse and granular, forming a large patch.

(*Mullus barbatus auratus* Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 280.)

Page 569. Instead of *Sciæna stellifera* read:

895. S. lanceolata (Holbr.) Gthr.

The identity of our species with *S. stellifera* (*trispinosa*) is very doubtful.

Page 570. To the description of *Sciæna argyroleuca* (*punctata*) add "lowest tooth of preopercle spinous, directed downward."

Page 571. *Sciæna ocellata* is known as "Red-fish" on our Gulf coast. It reaches a weight of 35 to 40 pounds. Old specimens entirely lose the serratures on the preopercle, the edge of the bone becoming membranaceous and entire as in "*Corvina*."

Page 572. Instead of "*cc*," etc., read:

292 (*c*).—**CORVINA*** Cuvier.

The species of "*Sciæna*" which have the preopercle without bony serratures may be referred to *Corvina*. Genus 296 (*b*), *Roncador* should probably be retained also.

Page 573. After *Corvina acuminata* add:

293 (2).—**EQUES** Bloch.

(Bloch Ichthyologia, about 1790: type *Eques americanus* Bloch.)

Body oblong, compressed, the back much elevated anteriorly. Mouth rather small, the lower jaw included; teeth in villiform bands, the outer somewhat enlarged above; preopercle serrate, the teeth flexible; pseudobranchiæ present. Scales moderate, extending on the soft fins. First dorsal of about 16 spines, the median spines much elevated; second dorsal extremely long. Anal very small; second anal spine small. Pyloric cœca few. Air-bladder simple. Vertebræ 10+15. (Latin, *Equus*, a horse; the long dorsal spines being compared to a rider.)

901 (*b*). **E. lanceolatus** (Gmel.) Casteln.

Greyish-yellow, with three broad blackish-brown bands, edged with whitish; the first vertical, from the crown, through the eye to the angle of the mouth; the second slightly arched, from the nape over the opercle to the base of the ventral; the third curved, from the top of the first dorsal along the middle of the side of the body to the middle of the caudal fin. Head small; maxillary 3 in head, reaching pupil. Height of first dorsal usually much more than depth of body below it. Head $3\frac{5}{6}$; depth $3\frac{1}{6}$. D. XVI–I, 53; A. II, 10; Lat. l. 60. West Indies; lately taken at Pensacola by Silas Stearns.

(*Chætodon lanceolatus* Gmelin, Syst. Nat. 1788, 1254: *Eques balteatus* C. & V. v, 165; Günther, ii, 279: *Eques americanus* Bloch. Ichth. taf. 347, fig. 1.)

Page 575. The synonym "*Homoprion xanthurus* Holbr." belongs to *Sciæna argyroleuca*, not to *Liostomus xanthurus*.

Page 575. *Genyonemus*. Several of the characters given in the text are inapplicable to South American species now referred to *Genyonemus*.

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* Cuvier, Règne Animal, ed. 2, ii, 173, 1829: type *Sciæna nigra* Bloch = *Sciæna umbra* L. in part, the species having been confounded by L. with *Sciæna umbra* (= *aquila* Lac.). The enlargement of the second anal spine, used by Cuvier to distinguish *Corvina* from *Sciæna*, has no taxonomic value. (*Corrina*, the Italian and Spanish name for various Sciænoids, originally from Latin *Corvus*, crow, in allusion to the dusky color of *C. nigra*.)

Some of these have the mouth subinferior, the barbels conspicuous, forming a tuft at the chin; the dorsal spines 10 and the caudal double-truncate; the gill-rakers short. The diagnosis should be amended accordingly.

Page 570. Instead of *Sciæna punctata* read:

896. S. chrysura (Lac.) J. & G.

(*Dipterodon chrysurus* Lacépède iii, 64, 1802.)

There are two species called *Perca punctata* in the Systema Naturæ, and the second of these should be suppressed.

Page 577. Instead of the account of *Menticirrus littoralis* substitute:

908. M. littoralis (Holbr.) Gill.—*Surf Whiting.*

Grayish silvery, nearly plain, without traces of bars; pectorals, ventrals, and anal pale, with a few black dots; caudal tipped with blackish; lining of opercle pale. Body rather elongate, the caudal peduncle very slender; snout bluntish, 3 in head, projecting beyond premaxillary for about one-sixth its length; maxillary reaching about to front of eye; posterior nostril lanceolate; outer teeth little enlarged, very much smaller than in *M. alburnus*. Gill-rakers small, but developed; lower lobe of caudal longest. Scales on breast very small, irregular. Head $3\frac{1}{6}$; depth $4\frac{2}{5}$. D. X–I, 23; A. I, 7; scales, 6–50–11. South Atlantic and Gulf coast. *M. undulatus* is closely related to this species.

M. alburnus is darker in color, usually with traces of dusky bars; pectorals blackish; lining of opercle black. Snout sharp, $3\frac{2}{5}$ in head; snout much projecting (one-third its length). Outer teeth of upper jaw very large; posterior nostril ovate; gill-rakers tubercular, almost obsolete; maxillary about reaching middle of eye. Scales on breast large, regularly placed. Head $3\frac{1}{2}$; depth $4\frac{1}{4}$. D. X–I, 24; A. I, 7; scales 6–54–11.

Page 578. *Menticirrus undulatus* has the outer teeth of the upper jaw not greatly enlarged and should have been placed rather under *a* instead of *aa*. *Umbrina elongata* Gthr., from the Pacific coast of tropical America, is a different species. The latter name should be erased from the synonymy of *M. undulatus*.

Page 578. The teeth in *Larimus* are mostly in single series. The genus "*Monosira*" Poey (Anal. Soc. Esp. Hist. Nat., x, 326, 1881), is identical with *Larimus*.

Page 579. The genus *Atractoscion* should be suppressed. Our species may stand as 912, *Cynoscion nobile* (Ayres) J. & G.

Page 581. The presence of one or two anal spines in *Cynoscion* has no importance. Probably a rudiment of the first spine will be found in all the species. *Cynoscion regale* and *Cynoscion nothum* are distinguished from our other species by having the second dorsal and anal covered with small scales; these fins being naked in the other species. *Otolithus drummondi* Rich. (Fauna Bor.-Amer. iii, 1836, 70; Günther, ii, 307), from New Orleans, is identical with *Cynoscion maculatum*. This species has the caudal unevenly truncate, not "lunate", as stated in the text.

Page 583. After *Gerres plumieri* add:

919 (*b*). **G. olisthostoma** Goode & Bean.—*Irish Pompano.*

Color silvery olivaceous; scales with faint silvery streaks but no dark ones; fins mostly pale or yellowish, the ventrals somewhat dusky. Body rhomboid, short and deep, the back elevated, the anterior profile straight and very steep; mouth rather large; teeth slender, brush-like. Preorbital entire; preopercle and interopercle serrate. Groove on top of head, for reception of premaxillaries, broad, rounded behind, with a median linear depression, its surface completely covered with small deciduous scales, which extend forward to just behind nostrils. Eye moderate. Dorsal spines high and strong, the second, nearly or quite as long as head. Second anal spine very strong, half or more length of head. Caudal lobes long and slender, a little longer than head. Pectoral long, nearly as long as head, reaching front of anal. Head 3; depth 2. D. IX, 10; A. III, 8; scales 5–37–9. L. 12 inches. West Indies, north to Southern Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 423: *Gerres rhombeus* Poey, Syn. Pisc. Cub. 1858, 32: *Mojarra rhombea* Poey, Anal. Soc. Esp. Hist. Nat. x, 327, 1881, not *Gerres rhombeus* C. & V. vi, 459; a species of similar form, but with two anal spines only, and the premaxillary groove entirely naked. The genus *Mojarra*, in Poey's arrangement, is distinguished from *Gerres* by the entire preorbital, and from "*Diapterus*" by the serrated preopercle.)

Page 584. Instead of *Gerres argenteus* read:

920. G. gula C. & V.

This species is distinguished from the other American species (except *Gerres homonymus*) by the presence of a transverse band of scales across the anterior part of the groove of the premaxillaries on the top of the head; behind these scales the naked part of the groove appears as a pit when the jaw is protruded. Third dorsal spine $\frac{2}{3}$ as long as head, twice as long as second anal spine. Head $3\frac{1}{4}$; depth $2\frac{2}{3}$. D. IX, 10; A. III, 7; scales 4–45–9. Tip of dorsal dusky. West Indies, north to Cape Cod.

To the synonymy of this species add:

(*Gerres gula* C. & V. vi, 464; Günther, i, 346, and iv, 255: *Diapterus gula* Poey, Synopsis Pisc. Cubens. 323, is a different species. The types of *Eucinostomus argenteus* B. & G. from New Jersey, are too young to be certainly identified. Numerous specimens collected by us in North and South Carolina belong to *Gerres gula*.)

Page 584. After *Gerres homonymus* read:

921 (*b*). **G. cinereus** (Walb.) J. & G.

Silvery; back and sides with 6 to 8 bluish vertical bars, about as broad as the pupil, these extending to opposite lower part of orbit; the bars formed of confluent blotches and rarely obsolete; axil dark; fins with some dark points. Body rather elongate, the back somewhat elevated and compressed, the belly nearly straight, with an angle at the breast. Teeth very small; preorbital and preopercle entire; furrow on top of head for premaxillary processes broad, scaleless, rounded behind. Dorsal spines slender, flexible, the longest $\frac{2}{3}$ head, half longer than second anal spine. Pectoral slender, rather longer than head. Caudal deeply forked, a little longer than head. Head $3\frac{1}{5}$; depth $2\frac{2}{5}$. D. IX, 10; A. III, 7; scales 5–40–10. L. 18 inches. The largest of our species of the genus. West Indies and both coasts of Mexico; north to Florida Keys and Gulf of California.

(*Mugil cinereus* Walbaum, Artedi Piscium 1792, 228 (after *Turdus cinereus peltatus* Catesby): *Gerres aprion* C. & V. vi, 461, 1830 (not of Günther): *Diapterus aprion* Poey, Syn. Pisc. Cub. 1868, 321: *Gerres zebra* Müller & Troschel, Schomburgk Hist. Barbadoes, 1848, 668: *Gerres zebra* Günther, i, 343 and iv, 254: *Gerres squamipinnis* Günther, i, 349 and iv, 254.)

The species of *Gerres* here noticed may be readily separated by the following analysis:

a. Preopercle serrate; anal rays III, 8; second anal, and third dorsal spines long; body elevated. (*Gerres*.)
  b. Preorbital serrate; furrow for premaxillary processes broad, naked; body striped ..... PLUMIERI.
  bb. Preorbital entire (*Mojarra* Poey); furrow for premaxillary processes broad, scaled; body not striped ..... OLISTHOSTOMA.
aa. Preopercle entire; anal rays III, 7; dorsal and anal spines comparatively low; body little elevated. (*Diapterus* Ranzani.)
  c. Premaxillary groove scaled in front, with a naked pit behind.
    d. Depth about half length; third dorsal spine little longer than second anal. HOMONYMUS.
    dd. Depth about $\frac{2}{3}$ length; third dorsal spine about twice length of second anal ..... GULA.
  cc. Premaxillary groove entirely naked.
    e. Premaxillary groove broad; back elevated, the depth about $\frac{2}{3}$ length; body with faint bars ..... CINEREUS.
    ee. Premaxillary groove linear; back scarcely elevated, the depth about one-third length; body not barred ..... HARENGULUS.

The character of "lower pharyngeals united" has little importance in this group. In *Gerres plumieri*, as in nearly all the species examined by us, the bones are not at all co-ossified, although very close together.

Page 586. "*Ditrema violaceum*" Hutton, from New Zealand, is a Scombroid fish, and not an Embiotocoid.

Page 590. The genus *Holconotus* Agassiz should be recognized for those species of *Amphistichus* which have the lower lip without frenum, and *Brachyistius* Gill for those of *Micrometrus*, which have the frenum. No. 930 should stand as—

930. H. argenteus (Gibbons) J. & G.

Page 600. Instead of *Tautoga* read:

316.—HIATULA Lacépède.

(Lacépède, Hist. Nat. Poiss. ii, 523, 1800: type *Labrus hiatula* L.=*Hiatula gardeni* Lac.) (Latin, *hiatus*, a gap.)

Instead of *Tautoga onitis* read:

942. H. onitis (L.) J. & G.

Page 600. Add to the synonymy of *H. onitis*—

(*Labrus hiatula* L. Syst. Nat.: *Labrus hiatula* Gmelin, Syst. Nat. 1287, 1788: *Hiatula gardeniana* Lacépède, Hist. Nat. Poiss. ii., 523, 1800; the genus and species, based on a specimen of *Tautog* which had in some way lost the anal fin; this specimen seems to have been sent from Charleston by Dr. Garden to Linnæus. If *Micropterus* and other generic names, based on abnormal or mutilated specimens, be adopted, we must substitute *Hiatula* for *Tautoga*.)

Page 602. Instead of *aa*, etc., read:

318 (*b*).—**TROCHOCOPUS** Günther.

(Günther, Cat. Fish. Brit. Mus. iv, 100, 1862: type *Trochocopus opercularis* Gthr.)

This group is distinguished from *Harpe* by the smaller scales (Lat. l. 45 to 65), which scarcely encroach on the bases of the soft dorsal and anal. In the present classification of the *Labridæ*, this group may be recognized as a distinct genus, although differing from *Harpe* in no respect of importance. Species few. (τροχος, a running; κώπη, oar.)

945. T. pulcher (Ayres) Garman.

Page 603. For *Platyglossus grandisquamis* and *P. humeralis* read:

947 (948). P. bivittatus (Bloch) Gthr.

This species seems to be widely distributed, and varies considerably with age and sex. The following is a description of the young ("*florealis*"), supposed by us at first to belong to a different species:

Olive-brown; a greenish stripe along side of back; a dark-brown lateral band from gill-opening to middle of caudal, on level of eye; a

dark-bronze stripe from pectoral backward; each scale of sides with a greenish-blue crescent; sides of head orange; a blue wavy stripe below eye, turning downward on subopercle; opercle with an indigo spot, bordered by bluish and yellow; tip of opercle yellow, the color bounded by a blue ⋖-shaped line; lower jaw with bands of orange and whitish; a small inky spot at base of last ray of soft dorsal; dorsal cherry-red, with translucent bands; caudal reddish; anal banded with red and pale; pectorals yellowish; ventrals white. Body slender; snout not very sharp; posterior canine small. Dorsal spines low, stiff and pungent; caudal short, obliquely truncate. Head $3\frac{1}{3}$; depth 4 ($4\frac{3}{5}$ in total). D. IX, 11; A. III, 12; scales $1\frac{1}{2}$–26–8. L. $3\frac{2}{3}$ inches. Pensacola Bay.

Old specimens, (Charleston, S. C.) are deeper-bodied and have the posterior part of the caudal, especially the angles, black or dark-blue, the basal part of the fin with concentric, convex, broad streaks of orange, with narrower bluish interspaces; the dorsal is largely orange, with a median blackish or brown band, which is often obsolete, its base with crimson spots; anal with a crimson band and some bluish streaks. Black spot at base of last dorsal ray disappearing with age. Females with the dark lateral band less distinct, the colors duller, the dark dorsal band more distinct than in the males. Head $3\frac{2}{3}$; depth 3, in adult. North Carolina to Surinam.

To the synonymy add:

(*Labrus birittatus* Bloch, Ichthyol. taf. 284, f. 1; *Julis psittaculus* C. & V. xiii, 387; Günther, iv, 164; Steindachner, Ichthyol. Notiz. vi, 49, 1867: *Platyglossus florealis* Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 287: *Platyglossus grandisquamis* and *humeralis*, this work, p. 603.)

948 (*b*). **P. caudalis** (Poey) Gthr.

Olivaceous; a row of sky-blue spots on each side of back; a broad area of orange, intermingled with violet spots, extending along sides, most conspicuous anteriorly; below this a band of pale violet, becoming posteriorly spots of deep violet; still lower a deep yellow band bounding the white of the belly; preorbital and suborbital scarlet, with 3 blue stripes, marked with cherry-red; cheeks below yellowish; opercles bright red, with 3 oblique violet stripes, the upper forming behind eye an oblique blotch, in the middle of which is a round ink-like spot; no opercular spot; dorsal orange, the soft part with 3 rows of violet spots; caudal orange and blue, the former color arranged in 1 longitudinal, 2 marginal, and 2 converging bands, which are joined by reticulations around bluish spots; anal with a basal row of orange spots, then blue spots, then a yellow band, then blue, then finally edged with

orange; ventrals red; pectorals mostly violet; spots on head and posterior parts bright clear blue, elsewhere duller and violaceous. Body very slender, the snout pointed; posterior canine large. Dorsal spines slender, but pungent; caudal convex, its corners slightly produced. Head $3\frac{1}{4}$; depth $4\frac{1}{4}$ (5 in total). D. IX, 11; A. III, 12; scales 2–25–6. Pensacola, Florida, to Cuba and Surinam (here described from young males).

(*?Julis caudalis* Poey, Mem. Cuba, ii, 213; ?Günther, iv, 166; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 286: *?Julis pictus* Poey, Mem. Cuba, ii, 214: *?Platyglossus pictus* Günther, iv, 166: *?Platyglossus poeyi* Steind. Ichth. Notiz. vi, 49, 1867.)

Page 606. Instead of *Hemistoma* substitute—

323.—SCARUS Forskål.

(Forskål, Fauna Arabica, 1775, 25: type *Scarus psittacus* Forskål.)

Omit from the description of the genus the following clauses: "Lateral line continuous." "Lower jaw included. Scales on the cheek in more than one series." "Dorsal spines flexible." Our species should stand as—

954. S. guacamaia C. & V.

Page 607. After *Scarus guacamaia* add:

954 (*b*). **S. croicensis** Bloch.—*Bullon.*

Bluish silvery, with three red longitudinal bands; the upper from the nape to the end of the dorsal; the second through the eye, crossing the space between the two portions of the lateral line; the third from the base of the pectoral to the lower half of the caudal fin; head mostly rosy; snout with bright-colored streaks; fins all yellow. Three series of scales on the cheek; the middle composed of five scales; the lower of three, and covering the limb of the preopercle. Caudal subtruncate. Teeth small, whitish or rosy; no posterior canine. Upper lip broad, covering more than half of upper jaw. Dorsal spines flexible. Head $3\frac{1}{2}$ in total length; depth $3\frac{2}{3}$. D. IX, 10; A. II, 8; Lat. l. 24. L. 7–8 inches. (*Cuv. & Val.*) West Indies, north to Southern Florida (*Bean*).

(Bloch, Ichth. 1797, 18, pl. 121: *Scarus insulæ-sanctæ-crucis* Bloch. & Schn. 1801, 285: *Scarus alternans* C. & V. xiv, 200: *Pseudoscarus sanctæ-crucis* Günther, iv, 226.)

bb. Dorsal spines pungent; scales on cheek in one series. (*Sparisoma** Sw.)

954 (*c*). **S. squalidus** Poey.—*Vieja Muger.*

Rosy olive; a black blotch on the upper half of base of pectoral; front of head with brownish reticulations; fins rosy; color in

* Swainson, Class. Fishes, ii, 227, 1839: type *Sparus abildgaardii* Bloch. (= *Scarus* Bleeker, not of Forskål, which is *Hemistoma* Sw. or *Pseudoscarus* Bleeker.)

spirits nearly plain; faint whitish streaks along the rows of scales on the sides. Teeth rather distinct; caudal emarginate, the outer angles produced; cheeks with about three scales. Head 3¼; depth 3. West Indies, north to Garden Key, Florida.

(Poey, Mem. Cuba, ii, 218, 1860; Poey, Syn. Pisc. Cub. 338.)

954 (*d*). **S. radians** C. & V.—*Spanish Porgy.*

Reddish olive; lower parts and anal rose-colored; dorsal fin and upper parts marbled with brownish; caudal with irregular dark cross-bands, including whitish spots, and with a narrow whitish edge; anal with four oblique dark spots; root of the pectoral blackish; a light band across chin. Snout not twice length of eye. Caudal truncate, the outer rays slightly produced in the adult, rounded in young. Teeth very distinct; young with pointed teeth directed outward around the jaw. Four scales on cheek. L. 8 inches. (*Günther*). Florida to Brazil.

(Cuv. & Val. xiv, 206; Günther iv, 211; Goode, Bull. U. S. Nat. Mus. v, 32.)

Page 608. After *Heros cyanoguttatus* add:

955 (*b*). **H. pavonaceus** Garman.

Dark brown, flecked with pale; 4 to 6 ocellated, vertically-expanded black spots on side below dorsal fin; an ocellated black spot on base of tail above lateral line; side with 10 or 12 faint dark cross-bands. Head as deep as long. Eye large, wider than preorbital, its front behind tip of maxillary; 5 rows of scales on cheek. Fifth dorsal spine highest; soft dorsal and anal reaching caudal; pectorals to vent. Head 2⅔; depth 2⅔. D. XVI, 12; A. V, 8; scales 4–32–12. Monclova, Coahuila. (*Garman.*)

(Garman, Bull. Mus. Comp. Zool. 1881, 93.)

Page 610. It is probably better to recognize the genus 325 (*b*), *Glyphidodon* Lac., distinguished from *Pomacentrus* by its notched teeth. Our species may stand as—

958. G. declivifrons (Gill) Gthr.

(*Euschistodus declivifrons* and *E. concolor* Gill, Proc. Ac. Nat. Sci. Phila. 1862, 37: *Euschistodus analogus* Gill, Proc. Ac. Nat. Sci. Phila. 1863, 220; Günther, iv, 38.)

959. G. saxatilis (L.) Lac.

Page 611. *Chromis punctipinnis* belongs to the subgenus *Furcaria* Poey (Memorias Cuba, ii, 195: type *Furcaria puncta* Poey = *Ayresia* Cooper), distinguished from *Chromis* proper by the more elongate body, the more deeply forked caudal, and by the presence of 12 dorsal spines.

Page 612. After *Chromis insolatus* add:

961 (*b*). **C. enchrysurus** J. & G.

Dusky bluish; a blue stripe from tip of snout through upper part of eye to above lateral line; caudal deep yellow; pectorals, most of soft dorsal, and distal half of anal, light yellow; fins otherwise dusky; a small black spot in axil. Body regularly ovate-oblong. Jaws equal, the maxillary $3\frac{1}{5}$ in head, extending a little past eye; preopercle with blunt serrations. Teeth slender, conical, in a moderate band. Dorsal emarginate, the longest spine $1\frac{1}{2}$ in head; caudal lunate; second anal spine $1\frac{2}{3}$ in head. Head $3\frac{1}{3}$; depth 2. D. XIII, 12; A. II, 12; scales 3–26–9. Pensacola, Fla.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 286.)

Page 615. After *Chætodon maculocinctus* add:

963 (*b*). **C. bimaculatus** Bloch.—*Four-eyed Fish; White Angel.*

Pearly gray; snout, edge of opercle, base of pectoral, anal, caudal, and dorsal bright yellow; a black band, edged with yellow, extending from a point in front of and below first dorsal spine across eye to margin of interopercle; soft dorsal with a large, round, indistinct black spot at its base, between fifth and twelfth rays, and a small, deep black spot at its angle; soft dorsal with a narrow marginal line of black; soft anal with a narrow submarginal band of light blue, edged anteriorly with black; caudal with a terminal band of bluish, the center bright yellow; base of ventrals blotched with yellow. Snout produced, longer than eye; preopercle finely denticulated. Soft dorsal and anal angular behind. D. XII, 20; A. III, 16; scales 6–34–15. (*Goode; Günther.*) West Indies, north to Key West (*Stearns*).

(Bloch, Ichth. vii, 1797, taf. 219; Günther, ii, 9; Poey, Memorias, ii, 371, 1861: *Sarothrodus bimaculatus* Goode, Bull. U. S. Nat. Mus. v, 43.)

963 (*c*). **C. capistratus** L.

A black, white-edged, ocular band, much narrower than the eye, extending over the interopercle, not over the chest; a round, black, white-edged spot immediately before the angle made by the dorsal fin and the back of the tail; blackish oblique streaks along the series of scales: those of the upper half of the body descending forwards; those of the lower ascending forwards; a grayish band, edged with black, across the middle of caudal, continued on the soft dorsal and anal fins, where it runs parallel with the margin and near it; ventrals whitish. Snout very slightly produced, nearly as long as eye; preopercle very faintly

serrate. Soft dorsal and anal angular behind. D. XIII, 19; A. III, 17; scales 6–42–17. (*Günther.*) West Indies, north to Florida Keys.

(L. Syst. Nat.; Günther, ii, 12.)

Page 615. After *Pomacanthus ciliaris* add:

964 (*b*). **P. tricolor** (Bloch) J. & G.—*Black Angel.*

Head, caudal fin, anterior part of trunk, and margins of soft dorsal and anal yellow; rest of body black. Preopercular spine grooved, reaching to posterior margin of opercle. Soft dorsal, anal, and upper ray of caudal, moderately produced. D. XIV, 19; A. III, 18; scales 8–48–25. (*Günther.*) West Indies, north to Florida Keys.

(*Chætodon tricolor* Bloch, Ichth. xii, 1797, taf. 425: *Holacanthus tricolor* C. & V. vii, 162: *Holacanthus tricolor* Günther, ii, 49.)

Page 617. After *Acanthurus chirurgus* add:

966 (*b*). **A nigricans** (L.) Bloch.

Closely related to *Acanthurus chirurgus*, differing in the longer snout, which is more convex in its upper portion. Caudal triangular, scarcely concave behind; vertical bands on the side very narrow, usually disappearing after death; fins without oblique stripes. (*Poey.*) West Indies, occasionally northward (said to have been once taken at New York).

(*Chætodon nigricans* Linn. Syst. Nat.: *Acanthurus phlebotomus* Cuv. & Val. x, 176, tab. 287, 1835: *Acanthurus phlebotomus* Poey, Anal. Soc. Esp. Hist. Nat. 1880, 245.)

966 (*c*). **A. tractus** Poey.

Distinguished most readily by the length of the caudal lobes, especially the upper, which is notably longer than the lower, its tip ending in a whitish thread; anterior profile moderately curved. Dorsal with faint oblique streaks. Body usually without dark streaks. West Indies and both coasts of Mexico, occasional northward.

(*Acanthurus chirurgus* C. & V. x, 168 (not *Chætodon chirurgus* Bloch); Poey, Mem. Cuba, ii, 208, 1860; Poey, Anal. Soc. Esp. Hist. Nat. 1880, 246.)

Page 628. *Astroscopus y-græcum* and *A. anoplus* are very closely related. The following distinctive characters may be found useful:

In *A. anoplus* the pale spots are much smaller, less sharply defined, and occupy a smaller area than in *A. y-græcum;* the lower part of head has two black blotches in both species; the second dorsal, anal, and ventrals are nearly or quite plain. The naked area behind each eye is, in *A. anoplus*, lunate, its length barely twice that of the snout; the bony V-shaped plate is short and broad, concave on the median line, and forked for about half its length, the posterior undivided portion broader

than long; the bony bridge across the occiput but little shorter than the part of the head which precedes it. In *A. y-græcum* the naked area is trapezoidal, longer than broad, and about 4 times the length of the snout; the Y is forked for more than half its length, its undivided part more than twice as long as broad, and not concave; the occipital plate is not half as long as the part of the head which precedes it.

Page 629. After *Astroscopus anoplus* add:

Family CIII (*b*)—OPISTHOGNATHIDÆ.

Body oblong or elongate, low, moderately compressed, covered with small, cycloid scales. Lateral line present, usually incomplete, straight, running close to the dorsal fin. Head large, naked, the anterior profile decurved. Mouth terminal, horizontal, its cleft usually very wide, the maxillary extending past the eye, and sometimes considerably beyond the head; supplemental maxillary present; premaxillaries protractile; jaws subequal, with conical or cardiform teeth; vomer usually with a few teeth; palatines toothless; opercles unarmed; no suborbital stay. Pseudobranchiæ present. Gill-rakers rather long; gills 4, a slit behind the fourth; gill-membranes united, free from the isthmus. Branchiostegals 6. Air-bladder present. No pyloric cœca. Dorsal fin long, continuous, its anterior half composed of slender, flexible spines; caudal distinct, rounded or lanceolate; tail diphycercal; anal long, without distinct spines; ventrals separate, jugular, I, 5, the middle rays longest; pectorals fan-shaped. Two genera, of about 12 species, inhabiting rocky bottoms in tropical seas. Their relationships are apparently with Trachinoid forms, but they bear considerable resemblance to the Clinoid Blennies. (*Trachinidæ*, genus *Opisthognathus* Günther, ii, 254–256.)

a. Maxillary of moderate length, truncate behind. ....Gnathypops, 338 (*b*).
aa. Maxillary of great length, prolonged in a flexible lamina behind.
Opisthognathus, 338 (*c*).

338 (*b*).—GNATHYPOPS Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1862, 241: type *Opisthognathus maxillosus* Poey.)

This genus includes those *Opisthognathidæ* in which the maxillary is of medium length and truncate behind. (γνάθος, jaw; ὑπω, below; ὠφ, eye.

977 (*b*). **G. maxillosus** (Poey) Gill.

Color grayish olive, with 7 irregular ⅄-shaped bars of darker, everywhere much marbled and variegated; fins all similarly marked, the

ventrals dusky, the dorsal with a dusky blotch in front. Body moderately compressed; head not very large; maxillary truncate behind, extending behind eye for a distance about $\frac{2}{3}$ diameter of eye, its length $1\frac{2}{3}$ in head; eye $2\frac{2}{3}$ in head. Teeth conical, curved, well separated, mostly in a single series. No teeth on vomer. Fins moderate; dorsal continuous, its spines slender; caudal short, its length $\frac{2}{3}$ head. Head $3\frac{5}{6}$; depth $4\frac{1}{3}$. D. VIII, 17; A. II, 13; Lat. l. 65. Cuba, north to Garden Key, Florida.

(*Opisthognathus maxillosus* Poey, Mem. Cuba, ii, 286, 1860; Poey, Syn. Pisc. Cub. 400.)

338 (*c*).—**OPISTHOGNATHUS** Cuvier.

(Cuvier, Règne Anim. ed. 2, 1829: type *Opisthognathus sonneratii* Cuv.)

Maxillary prolonged backward in a long, flexible lamina, which sometimes reaches base of pectoral. Characters of the genus otherwise included above. (*ὄπισθη*, behind; *γνάθος*, jaw.)

977 (*c*). **O. scaphiurus** Goode & Bean.

Grayish olive, much variegated with whitish and dark olive; about 6 irregular dusky bands on the body, which extend on the dorsal fin; whitish markings on body forming roundish spots, surrounded by reticulations of grayish olive; head marbled, its posterior part, as well as the sides of the back and pectoral base, with small blackish dots; membrane lining the inside of the maxillary with 2 curved inky-black bands on a white ground; angle of mouth with a black spot; lining of opercle black; fins all variegated like the body. Body moderately elongate, somewhat compressed. Head blunt anteriorly; snout very short, about as long as pupil; eye large, 4 in head; maxillary reaching slightly past edge of preopercle, but not to end of head, its length contained $3\frac{3}{4}$ times in length of body. Teeth rather strong, wide-set, forming 2 distinct series, directed backward, especially in the upper jaw; lateral teeth of lower jaw largest; a single vomerine tooth. Gill-rakers long and slender, nearly 20 below angle. Scales very small. Dorsal fin low, continuous, the soft rays but little higher than the spines, which are slender and flexible, the longest $3\frac{1}{3}$ in head. Caudal short, rounded, its length $5\frac{3}{5}$ in body. Anal similar to soft dorsal. Pectoral half as long as head. Depth 5. D. XI, 16; A. 18; P. 17; Lat. l. 109. Florida Keys.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 417.)

977 (*d*). **O. lonchurus** J. & G.

Olivaceous; margin of upper lip with a narrow black stripe; caudal with 3 dusky bars; color of rest of body nearly uniform. Head not very

large; snout very short, shorter than pupil; eye $3\frac{1}{3}$ in head; maxillary $1\frac{1}{3}$ in head, rather narrow; lower jaw included; vomer with 5 rather large teeth. Longest dorsal spine about as long as head, slightly higher than soft rays; caudal long, the middle rays scarcely shorter than head; longest anal rays $1\frac{1}{5}$ in head; pectoral little more than half head. Scales moderate. Head $3\frac{1}{3}$; depth $4\frac{3}{5}$. D. 25; A. 15; Lat. l. 67. Two specimens known, taken from the stomach of a Red Snapper at Pensacola, Fla.

(Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 290.)

Page 630. In key, under *jj*, after the word "series," add "in lower jaw."

Page 632. *Dormitator lineatus* is apparently identical with *D. maculatus*, and may be suppressed. The genus *Dormitator* is best distinguished from *Eleotris* by the numerous long, lamelliform appendages of the narrow lower pharyngeal bones. In *Philypnus*, *Culius*, and *Eleotris* the bones are broader, and without appendages.

341 (*b*).—**CULIUS** Bleeker.

(Bleeker, Boeroe, 411: type *Eleotris niger* Q. & G. = *Pœcilia fusca* Bl. & Schn.

This genus is distinguished from *Eleotris* by the presence of a stout hook-like spine, directed downwards and forwards, near the angle of the preopercle. Gill-openings extended forwards. Teeth fixed. Species rather numerous in brackish and fresh waters of tropical regions. (Name of Indian origin.)

981 (*b*). **C. amblyopsis** Cope.

Dull olivaceous; everywhere dusted with dark points; finely barred with paler; a black streak from eye to upper edge of gill-opening; a blackish spot above base of pectoral. Form of *Eleotris gyrinus*. Maxillary reaching middle of eye, $2\frac{3}{4}$ in head; teeth of the inner series in each jaw largest. Scales larger than in other species of the genus. Head $3\frac{2}{5}$; depth $5\frac{3}{4}$. D. VI, 9; A. 8; Lat. l. 48. South Carolina to West Florida and Surinam.

(Cope, Trans. Am. Philos. Soc. Phila. 1870, 473.)

Page 632. *Gobius catulus* Grd. proves to be a true *Gobius*, and is identical with *Gobius soporator*. It should, therefore, be erased. The upper rays of the pectoral are silk-like. Head $3\frac{1}{3}$; depth $4\frac{1}{6}$. D. VI–10; A. I, 9; Lat. l. 33 to 38; 12 rows between dorsal and anal. It is very abundant about rocks and ballast heaps from Florida to Texas.

Professor Gill informs us that one of the species of *Gobius* described by Girard from Texas is, however, undoubtedly a true *Evorthodus*. As all of these species, except *G. würdemanni*, have now been accounted for, the latter species may be provisionally referred to *Evorthodus*.

Page 633. No. 983, *Euctenogobius lyricus* is a marine species, found along the coast of Texas. The genus *Euctenogobius* intergrades with *Gobius* and can hardly be retained.

Page 633. After *Gobius lyricus* add:

983 (*b*). **G. encæomus** J. & G.

♂ olivaceous, mottled with darker above; a series of 4 obscure oblong dark blotches along middle of sides; a dark spot at base of caudal; each side of nape with an intense blue-black spot larger than eye; an obscure dusky streak from eye forward to mouth. Both dorsals translucent, with series of bright reddish-brown spots as large as pupil; upper lobe of caudal light reddish, the lower blue-black; anal and ventrals dusky-bluish; pectorals slightly dusky, with a narrow bright pinkish border behind. Body very elongate; head compressed; cheeks high and vertical; snout very short, vertically rounded. Mouth nearly horizontal, large, the maxillary nearly half head, reaching about to posterior margin of orbit; upper jaw with an outer series of strong curved canines, the inner series and those in lower jaw small. Interorbital width about equaling pupil; eye about $\frac{1}{3}$ head; gill-opening $2\frac{1}{3}$ in head; the isthmus wide. Dorsal spines not filamentous; soft dorsal and anal high, reaching caudal when depressed; caudal lanceolate, the middle rays produced, $2\frac{2}{3}$ in length. Pectoral rays not silk-like. Body covered with small ctenoid scales, much reduced anteriorly; head, antedorsal region, and breast naked. ♀ with smaller mouth and no red on fins. Charleston, S. C.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

Page 634. *Gobius carolinensis* Gill is indistinguishable from *Gobius soporator*, and may be suppressed. *Gobius mapo* Poey (Mem. Cuba, ii, 277), seems to be the same species.

Page 634. *Gobius gulosus* Grd. is a species of *Lepidogobius*, and should be transferred to page 638, after *L. newberrii*. It may be thus defined:

992 (*b*), **986. L. gulosus** (Grd.) J. & G.

Light olive, with sharply-defined markings of dark brown; those on the head mostly longitudinal streaks; those on the body forming dark

cross-bars and blotches; fins mostly spotted or barred. Body elongate. Head large, low, not very blunt. Mouth large, very oblique, the mandible strongly projecting; the maxillary extending to below middle of pupil, 2 in head. Teeth in few series, those of the outer row very long, slender, and curved. Scales small, cycloid, imbedded. Head and nape scaleless. Dorsal spines slender, the longest somewhat filamentous; caudal long; upper pectoral rays not silk-like; ventrals inserted directly below pectorals. Head $3\frac{1}{2}$; depth 5. D. VI–15; A. 16; Lat. l. 42. L. 3 inches. Florida to Texas.

(*Gobius gulosus* Grd. U. S. Mex. Bound. Surv. Ichth. 1859, 26.)

Page 635. Before *Gobius glaucofrænum* insert—

987 (*b*). **G. boleosoma** J. & G.

Pale olivaceous, mottled with darker; male with a black humeral spot; fins barred, their edges tinged with orange. Form, size, and coloration of *Boleosoma olmstedi*. Head not very blunt. Mouth moderate, horizontal, the lower jaw included; the maxillary reaching nearly to middle of eye. Teeth small, slender, in narrow bands, the outer somewhat larger. Scales moderate, ctenoid. Dorsal spines not filamentous; caudal pointed, slightly longer than head; upper rays of pectorals not silk-like. Head 4; depth $4\frac{1}{2}$. D. VI–12; A. I, 11; Lat. l. 33. L. 2 inches. Pensacola, Fla.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 295.)

987 (*c*). **G. stigmaturus** Goode & Bean.

Light olive, sides marbled with whitish; a dusky spot on opercle and one below eye; sides with 5 dusky blotches along median line, the last one a round black spot at base of caudal; vertical fins with wavy blackish bars; paired fins plain. Form of *G. boleosoma;* head not very blunt; snout little shorter than eye; lower jaw not shorter than upper. Maxillary extending to below middle of eye, $2\frac{2}{3}$ in head. Teeth strong, curved, those of the upper jaw in a narrow band, two of the teeth somewhat canine-like; lower teeth large, in a single irregular series. Scales large, those on the nape reduced, all ctenoid. Dorsal spines slender; fins not elevated; caudal as long as head; upper rays of pectoral not silk-like. Head 4; depth 6. D. VI–12; A. 12; Lat. l. 30. L. 2 inches. West coast of Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 418.)

987 (*d*). **G. nicholsi** Bean.

Olivaceous; scales edged with dusky; top of spinous dorsal black; second dorsal and caudal spotted with dark; ventrals black. Body

stout, compressed. Snout obtuse, about as long as eye; maxillary reaching front of pupil; lower jaw slightly projecting; teeth slender, in several series, the outer enlarged. Last rays of soft dorsal nearly as long as head; caudal convex, nearly as long as head; pectoral as long as head, none of its rays silk-like. Scales large; head naked. Head $3\frac{3}{4}$; depth $4\frac{1}{2}$. D. VI–14; A. 12; scales 26–10. L. $4\frac{1}{2}$ inches. Coast of British Columbia. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. 1881, 469.)

Page 636. After *Gobionellus oceanicus* add:

989 (*b*). **G. stigmaticus** Poey.—*Esmeralda.*

Brown; head with 4 vertical broad black bands; 3 on the cheek, 1 on the opercle; body with 10 narrow vertical yellow bars; pectorals and caudal with cross-rows of brown spots; ventrals yellow, with black edgings; a small black shoulder spot. Profile bluntly decurved; maxillary reaching past middle of orbit. Teeth slender, in bands, the outer row enlarged. Pectoral as long as head; caudal pointed, half as long as body. Scales ciliated. Head 4; depth $4\frac{1}{2}$. D. VI–12; A. 13; Lat. l. 30. (*Poey.*) Southern Florida (*Bean*) to Cuba.

(*Smaragdus stigmaticus* Poey, Memorias Cuba, ii, 281, 1860; Poey, Syn. Pisc. Cub. 394.)

The scales in *Gobionellus oceanicus* vary considerably. Lat. l. 60 to 80.

Page 637. After *Lepidogobius gulosus* add:

992 (*c*). **L. thalassinus** Jor. & Gilb.

Body translucent, very thickly covered with very minute, shining-green dots, least numerous on tail; three conspicuous translucent bars, wider than the interspaces, crossing sides immediately behind head; two narrow brilliantly-green lines running obliquely across cheeks; dorsals whitish, with two or three lengthwise series of large reddish-brown spots; spinous dorsal blackish at base; anal whitish at base, the anterior rays tipped with brilliant white, the greater portion of fin, as well as lower part of caudal fin, blackish; upper caudal rays marked with red; ventrals light buff; pectorals translucent. Body elongate, much compressed; caudal peduncle very narrow and short; head compressed, much higher than wide, with very short, acute snout; mouth terminal, wide and oblique; the jaws equal; maxillary reaching vertical from middle of orbit, half length of head. Teeth apparently in a very narrow band, behind an outer series of strong conical teeth (the inner band cannot be certainly verified in our specimens). Eyes high, sepa-

rated by a very narrow interorbital space. Dorsal spines slender, the fifth slightly produced, reaching base of third soft ray when depressed. Last rays of dorsal and anal reaching slightly past base of caudal. Caudal lanceolate, the middle rays produced, $2\frac{2}{3}$ in body. Upper pectoral rays not silk-like. Ventral longer than head, reaching beyond front of anal. Body covered with very small cycloid scales, which are readily deciduous; head naked. Head $3\frac{1}{2}$; depth $4\frac{3}{4}$. D. VII–16; A. 15. L. $1\frac{1}{2}$ inches. Charleston Harbor. This species is closely allied to *L. emblematicus* Jor. & Gilb., from Panama.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

Page 638. Instead of *Gobiosoma alepidotum* read:

993. G. bosci (Lac.) J. & G.

To the synonomy add:

(*Gobius bosc* Lacépède, Hist. Nat. Poiss. ii, 555, 1800. The name *alcpidotus* was given by Schneider in 1801 as a substitute for this personal name.)

Page 638. *Gobiosoma molestum* is not distinguishable by us from *G. bosci.* It may therefore be suppressed.

Page 638. After *Gobiosoma bosci* add:

993 (*b*). **G. ios** Jor. & Gilb.

Light olive; back, sides, and upper fins speckled with dark olive; caudal with 3 or 4 dark olive cross-bars; lower fins pale. Body long and slender, moderately compressed; head long and low, anteriorly pointed, its profile scarcely convex; mouth very large, oblique, the jaws subequal; maxillary reaching middle of cheek, its length more than half head; teeth slender, in moderate bands, the outer somewhat enlarged. Eye as long as snout, $4\frac{1}{2}$ in head. Body entirely naked. Fins low, the spines slender; caudal short. Head $4\frac{1}{6}$; depth $6\frac{2}{3}$. D. VI–15; A. 12. L. 2 inches. Puget Sound; one specimen known, from the stomach of a *Hexagrammus asper.*

(Jor. & Gilb. Proc. U. S. Nat. Mus. 1882.)

Page 639. After *Tyntlastes sagitta* add:

350 (*b*).—**IOGLOSSUS** Bean.

(Bean, Proc. U. S. Nat. Mus. 1882, 419: type *Ioglossus calliurus* Bean.)

Body elongate, strongly compressed, of equal depth throughout, covered with very small, mostly cycloid, scales. Head short, compressed, not keeled above; mouth large, oblique, the lower jaw projecting; teeth in narrow bands or single series, some of them canine; no teeth

on vomer or palatines; tongue very slender, sharp; opercles unarmed. Gill-openings very wide, the membranes narrowly joined to the isthmus on the median line. No lateral line. Branchiostegals 5. Dorsals separate; the first of 6 very slender, flexible spines; the second elongate, similar to the anal; caudal long and pointed, free from dorsal and anal; ventrals close together, separate, each of one spine and *four* rays, their insertion below or behind pectorals; anal papilla present. (ιος, dart; γλῶσσα, tongue.) A remarkable type, belonging to the *Oxymetopontinæ*, differing widely from our other Gobioid fishes.

996 (*b*). **I. calliurus** Bean.

Light olive, without distinct markings (in spirits); tip of first dorsal dusky; caudal apparently with a median reddish stripe and two bluish bands. Head not crested, its upper surface gently rounded; maxillary extending to opposite front of pupil, $2\frac{1}{6}$ in head; upper jaw with about 2 series of teeth, the outer enlarged; 2 curved canines behind the band; lower jaw with about 1 row of smaller teeth, besides about 4 canines. Eye large, twice length of snout, $3\frac{1}{5}$ in head. Gill rakers long and slender. Dorsal fins contiguous, the longest spine filamentous, about as long as head; caudal lanceolate, half as long as rest of body; ventrals inserted very slightly in advance of pectorals, nearly as long as head. Scales minute, mostly cycloid. Head 5; depth $7\frac{1}{4}$. D. VI–22; A. I, 21. L. 4 inches. Deep water off Pensacola, Fla.

(Bean, Proc. U. S. Nat. Mus. 1882, 419; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 297.)

Page 642. *Hexagrammus ordinatus* is a typical *Hexagrammus*, having the dorsal fin divided. The genus *Pleurogrammus* should probably be adopted for *H. monopterygius*, which is, in Alaska, one of the most important food-fishes, according to Dr. Bean.

Page 644. Dr. Bean considers our suggestion, that *Hexagrammus scaber* is the young of *H. asper*, as improbable. The following are the characters assigned to the former species:

999 (*b*). **H. scaber** Bean.

Light brown, silvery below; each dorsal with 3 dark blotches, smaller than eye, not reaching base of fin; pectorals, ventrals, and anal immaculate. Teeth on jaws and vomer; none on palatines. A tentacle above eye. Six lateral lines on each side; the supplemental one faint, extending backward from above base of pectoral, disappearing near middle of body. Scales everywhere very rough. Caudal forked; dorsal deeply

notched. Head $4\frac{1}{4}$; depth $4\frac{1}{2}$. D. XX, 24; A. 23; Lat l. 105; l. tr. 50. L. 3 inches. Coast of Alaska; known from young specimens only.

(Bean, Proc. U. S. Nat. Mus. 1881, 154.)

Page 661. *Sebastodes proriger* ranges northward to Alaska, where it grows to a considerable size. In the original descriptions, both of "*Epinephelus ciliatus*" and "*Perca variabilis*," it is evident that *S. proriger* has been confounded by Tilesius and Pallas with the species for which we have retained the name of *S. ciliatus*.

On page 665, after *Sebastodes ruber*, add:

1019 (*b*). **S. umbrosus** J. & G.

Light orange, overlaid everywhere with blackish, the latter color forming on the lower part of the sides reticulations in fine pattern, the centers of the scales being paler than the edges; sides of head with dusky shades; sides of back with some large areas of blackish; upper parts with 5 large rounded blotches of pink washed with orange, these blotches arranged as in *constellatus*, but larger, less sharply defined, and of a different hue; the second blotch with a smaller one above it; a rosy spot on opercular flap; fins pale orange, shaded with dusky. General form of *constellatus*. Mouth moderate, oblique, the lower jaw scarcely projecting, its tip fitting into the emarginate tip of upper jaw; maxillary 2 in head, reaching posterior margin of pupil; both jaws with small, smoothish scales. Cranial ridges rather sharp, lower than in *constellatus;* preocular, supraocular, postocular, tympanic, and occipital spines present; interorbital area concave, with two prominent ridges; the region much broader than in *constellatus*, $\frac{2}{3}$ width of eye; supraocular ridge low, its spine smaller than tympanic spine; preocular prominent; preopercular spines all acute; preorbital narrow, with two spines. Eye large, 4 in head. Gill-rakers rather long and slender, the longest about half eye. Scales moderate, with many accessory scales. Dorsal rather low, deeply emarginate; fourth spine equal to soft rays, about $\frac{2}{5}$ head; soft dorsal longer than high; second anal spine large, $2\frac{1}{2}$ in head; caudal slightly emarginate; pectoral not reaching vent, $3\frac{2}{3}$ in body. Head $2\frac{3}{5}$; depth $2\frac{4}{5}$. D. XIII, 12; A. III, 6; Lat. l. 40 (tubes). Santa Barbara, California.

(*Sebastichthys umbrosus* Jor. & Gilb. Proc. U. S. Nat. Mus. 1882.)

Page 679. The species here called *Scorpæna dactyloptera* proves to have been correctly identified with the European species. It has lately been taken in considerable numbers along the Gulf stream. The

pectorals in this species are subtruncate, the lower rays somewhat exserted. The group called by Poey "*Pontinus*" is not of this type, but allied rather to *Scorpæna* proper.

Page 681. *Scorpæna porcus* should probably be erased, its occurrence in our waters being very doubtful. The following species has been, perhaps, mistaken for it:

1038 (*b*). **S. stearnsi** Goode & Bean.

Dusky olivaceous, whitish below; head with some dark blotches and small spots; back and sides with diffuse blackish blotches; body sparsely covered with round dusky spots, smaller than pupil; these spots most numerous and distinct in the axillary region, which is otherwise whitish; spinous dorsal marbled, with a median dusky band; its base whitish, with black spots; soft dorsal and anal irregularly marbled; caudal with a broad median and a terminal band of blackish; pectorals mottled and banded; ventrals dusky at tip. Body robust, little compressed, tapering posteriorly. Mouth moderate, oblique, the jaws equal, the lower with a small symphyseal knob; maxillary 2 in head, reaching to below posterior margin of orbit. Preorbital with two diverging spines; suborbital without deep pit, its stay low, armed with two small spines; nasal spines inconspicuous; interorbital space deeply concave, with 2 longitudinal ridges, its width $\frac{3}{5}$ diameter of eye. Cranial ridges rather low, moderately sharp; the following pairs present: preocular, supraocular, postocular, coronal, occipital, nuchal, besides 3 on the temporal region, arranged in a right line behind the eye. Occipital pit deep, a little broader than long. Preopercular spines 5, the two lower blunt and short, the upper much the longest, half as long as the eye; a small spine at its base. Supraocular flap very small, trilobate, shorter than pupil (much larger in a young example, apparently of the same species, in which its length is about half head). Small dermal flaps elsewhere on head. Opercular flap scaly; a few rudimentary scales on cheeks and front of opercle. Breast with small scales. Gill-rakers short and thick. Scales large, smooth, with membranous edges; a series of dermal flaps along the lateral line and at the dorsal base. Dorsal spines slender, the longest $2\frac{1}{4}$ times in head; longest soft ray half as long as head; caudal subtruncate, $1\frac{1}{5}$ in head. Anal spines small, the second and third equal, $2\frac{4}{5}$ in head. Longest soft ray of anal half as long as head. Ventrals $1\frac{3}{4}$ in head. Pectorals reaching soft rays of anal, the longest ray slightly shorter than head;

base of the fin a little procurrent, its length 3 in head. Head $2\frac{3}{5}$; depth $2\frac{5}{6}$. D. XI, I, 9; A. III, 5; P. 20; Lat. l. 32 (31 tubes). South Carolina to Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 421.)

1038 (*c*). **S. calcarata** Goode & Bean.

Color essentially as in *S. stearnsi;* axil of pectoral whitish, with dusky specks, a black spot at its upper edge; ventrals mostly black. Body moderately robust; lower jaw slightly projecting, with a small symphyseal knob; maxillary reaching past pupil, its length half head. Suborbital without pit, the bony stay moderate, armed with 2 small spines. Nasal spines small. Interorbital space narrow, with 2 longitudinal ridges, its width $\frac{2}{5}$ length of eye. Cranial ridges rather low, with sharp spines, arranged as in *S. stearnsi.* Occipital cavity almost obsolete, represented by a slight depression. Preopercular spines 5, the lowermost stout, directed *downward and forward*, the uppermost rather long, more than half eye. Opercular and scapular spines moderate. Eye large, nearly 3 in head. Supraocular flaps minute; a few other small flaps on head. Cheeks with rather large imbricated scales; opercle, with some scales anteriorly and on its flap; breast scaly; scales of body large, not ctenoid, with few dermal flaps or none. Pores of lateral line very conspicuous. Gill-rakers short and small. Dorsal spines rather slender, the longest $2\frac{2}{3}$ in head; longest soft ray $2\frac{1}{2}$ in head. Anal spines small, the second and third subequal, 3 in head. Soft anal rays moderate. Ventrals reaching past vent, $1\frac{3}{5}$ in head. Pectoral long, $1\frac{1}{5}$ in head. Depth 3. D. XI, I, 9; A. III, 5; P. 19; Lat. l. 28 (25 tubes). West coast of Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 422.)

Page 688. *Cottunculus microps* is very fully described and well figured by Collett, Norske Nord-Havs Exp. 1880, 18. The eye is here represented as shorter than snout, and about 6 in head, the pectorals reach past front of anal, and the dorsal rays are VI–13 to VI–15. It is possible that the American species is different, but the resemblance of the two is very great.

Page 691. It is thought by Collett (Norske Nord-Havs Exp. 1880, 34) that *Icelus bicornis* is identical with *Icelus hamatus.* If this supposition is correct, the species should stand as 1048, *I. bicornis* (Reinh.) Gill. *Icelus furciger* Malm (Forh. Skand. Naturf. 1863, 410) is identical with *I. hamatus.* In life the head of this species is provided with very slender cirri.

Page 694. Instead of *Uranidea spilota* read:

1054. U. ricei (Nelson) J. & G.

Erase the synonym "*Uranidea spilota* Cope," etc. *U. spilota* is probably a distinct species, allied to *U. cognata*.

Page 695. After *Uranidea semiscabra* add:

1056 (*c*). **U. rhothea** Rosa Smith.

Dusky, with blackish cross-bands above, yellowish and punctulate below; fins all more or less spotted and barred. Body moderately elongate. Head broad and flattish; interorbital space broad and little concave, nearly as broad as eye. Mouth moderate, the maxillary extending about to middle of pupil; jaws subequal; palatine teeth conspicuous; preopercular spine shortish, nearly straight, directed upward and backward. Skin of head smooth; skin of back and sides rough, with short, rather coarse prickles, shorter and stiffer than in *U. aspera*. Fins moderate; pectoral barely reaching past front of anal. Head 3; depth $4\frac{3}{5}$. D. VIII–15; A. 11; V. I, 4. Spokane Falls, Upper Columbia River.

(Rosa Smith, Proc. U. S. Nat. Mus. 1882, 347.)

Page 697. Under *Uranidea richardsoni* add another "variety"—var. *kumlieni* (Hoy).

The original type of *U. kumlieni* Hoy, lately re-examined by us, has palatine teeth, and the ventrals I, 4. It represents, in our present view, a variety of *U. richardsoni*, possibly distinguishable from var. *bairdi* by the rather higher spinous dorsal and rather larger eye and mouth. The description of "*U. franklini*," on page 699, belongs to *U. kumlieni*, being taken from Hoy's type.

Page 698. To the account of *Uranidea cognata* may be added: Mouth larger than in *Uranidea gobio;* head 3 in length without caudal; its width equal to its length and half more than its height; jaws equal; vent a little nearer snout than insertion of caudal; second dorsal twice as long as first, separated from it by a space less than a line; anal beginning opposite sixth ray of dorsal; caudal 6 in total length. Under surface silvery gray, minutely dotted; on the sides the dots are mingled with crowded irregular blotches of dark brown; back and top of head nearly uniform dark brown, few pale spots appearing. L. 4 inches. (*Richardson.*)

Page 698. After *Uranidea cognata* add:

1062 (*b*). **U. spilota** Cope.

Brown above, yellowish below, everywhere densely punctulate with darker except on the belly; dorsals, caudal, and pectorals barred; anal yellowish; dorsal and base of caudal with blackish spots; sides with large dark spots, forming sometimes seven or fewer cross-bars. Body rather elongate. Eye $4\frac{1}{2}$ in head, one-third greater than interorbital width. Head slightly contracted laterally, not much depressed; one preopercular spine (hooked upward); pectoral reaching vent and front of second dorsal, its rays undivided. Spinous dorsal low; anal beginning opposite fourth ray of spinous dorsal. No trace of palatine teeth. Lateral line incomplete. Head $3\frac{1}{5}$; depth 5. D. VIII–17; A. 13; V. I, 4; P. 15; B. 6. L. 3 inches. Grand Rapids, Michigan. (*Cope.*)

(Cope, Proc. Acad. Nat. Sci. Phila. 1865, 82.)

1062 (*c*). **U. pollicaris** J. & G.

Light olive above, blotched and spotted with black; lower part of sides and below light, unmarked; dorsals, pectorals, and caudal with series of spots. Head much depressed; snout broad and flat; profile straight or slightly concave from nape to tip of snout; mouth small, anterior; maxillary reaching vertical from front of orbit; teeth on vomer, none on palatines. Preopercular spine large and strong, spirally curved upwards and inwards; a single concealed point below this on margin of preopercle. Spinous dorsal rather low, connected with the long, low second dorsal by membrane; longest dorsal spine equalling length of snout; origin of anal under third dorsal ray; last ray of anal under sixteenth of dorsal; ventrals I, 4, reaching $\frac{2}{3}$ distance to vent; pectoral rays all simple; vent midway between tip of snout and base of caudal. Lateral line continuous to base of caudal. No prickles. Head $3\frac{3}{5}$ in length; depth $4\frac{3}{4}$; eye $5\frac{1}{3}$ in head. D. VII–19; A. 13; P. 17. Lake Michigan.

(Jor. & Giib. Proc. U. S. Nat. Mus. 1882.)

Page 699. Instead of the description of *Uranidea franklini*, given in the text, insert the following:

1069. U. franklini (Ag.) Jor.

Body rather short and stout; snout not very obtuse; maxillary reaching about to pupil; eye 4 in head, twice the interorbital space; preopercular spine hook-like, very acute; paired fins rather short, the pectorals not reaching vent; first dorsal nearly as high as second;

dorsals contiguous; anal inserted under fourth ray of second dorsal; caudal 6 in length; lateral line incomplete; vent nearer base of caudal than tip of snout. Head $2\frac{1}{2}$; depth $4\frac{1}{2}$. D. VIII–17; A. 12; V. I, 3. L. 3 inches. Lake Superior. (*Girard.*)

Page 699. After *Uranidea franklini* add:

1069 (*b*). **U. formosa** (Grd.) Jor.

Body slender and graceful; head small, depressed above; eyes moderate; preopercular spine short, stout, acute, curved upwards; a small spine below it; subopercular spine well developed. Dorsals well separated; anal beginning under third ray of soft dorsal; pectorals not reaching to posterior margin of spinous dorsal; ventrals not nearly to vent. Head $4\frac{1}{4}$. D. VIII–16; A. 11; V. I, 3. L. $3\frac{1}{4}$ inches. Deep water in Lake Ontario. (*Girard.*)

(*Cottus formosus* Girard, Mon. Cott. 58, 1850.)

Page 703. To the synonymy of *Cottus scorpius grœnlandicus* add:

(*Cottus mitchilli* C. & V. iv, 188: *Cottus porosus* C. & V. viii, 498: *Acanthocottus ocellatus* H. R. Storer, Bost. Journ. Nat. Hist. 1850, 253: *Cottus glacialis* Rich. Last Arctic Voyage Belch. ii, 349, 1855: *Acanthocottus mucosus* Ayres, Proc. Cal. Ac. Nat. Sci. 1854, 12.)

Page 712. A minute patch of palatine teeth is sometimes present in *Liocottus hirundo*.

Page 726. Instead of *Brachyopsis* read:

383.—LEPTAGONUS Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1861, 259: type *Agonus spinosissimus* Kröyer = *Agonus decagonus* Bl. & Schn.)

The species should stand as—

a. Lower jaw projecting. (*Brachyopsis* Gill.)

1112. L. rostratus (Tiles.) J. & G.

1113. L. verrucosus (Lock.) J. & G

1114. L. xyosternus J. & G.

aa. Lower jaw included. (*Leptagonus.*)

1115. L. decagonus (Bl. & Schn.) J. & G.

The following description of *L. decagonus* may be substituted for that given in the text:

Greyish yellow, with 2 to 4 large transverse brown spots; tips of pectorals and caudal blackish; a black streak through eye across preo-

percle. Body slender; head rather low; mouth large, subinferior, the snout projecting beyond it; gill-membranes free from isthmus (*fide Collett in lit.*); five long cirri near the angle of mouth, one of them forked; a forked cirrus on lower jaw; snout longer than the large eye; the longest cirri about as long as snout; a pair of short spines on snout; a pair of knotty protuberances above eye, and a pair of larger ones on frontal region; shields of anterior part of back each with a large keel ending in a spine; keels elsewhere bluntish; plates of breast tubercle-like and striate; 4 shields between dorsals; 5 before first dorsal; 17 before second; 12 between ventrals and anal. Pectorals slightly longer than head; ventrals moderate, longest in the males, the vent close behind them. Head 5; depth 8. D. VI–7; A. 7; Lat. l. 40, the number of pores about 24. L. 9 inches. Greenland to Norway. (*Collett.*)

(Collett, Norske Nord-Havs Exp. 1880, 44.)

Page 728. *Agonus cataphractus.*

This species should probably be omitted as not occurring within our limits, the Greenland references belonging to *Leptagonus decagonus.*

Page 728. The genus *Bothragonus* Gill here appears for the first time, the portion of Bull. U. S. Nat. Mus. XI, in which it was to be characterized having been withdrawn by the author.

Page 733. *Trigla cuculus* should doubtless be omitted. It probably has never been taken on our coasts.

Page 734. Instead of 1123, *Prionotus punctatus* read:

1123. P. scitulus J. & G.

For the synonymy given, substitute—

(*Prionotus punctatus* Jor. & Gilb. Proc. U. S. Nat. Mus. 1878, 373, not of C. & V.; Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 228.)

Page 734. After *Prionotus scitulus* read:

1123 (*b*). **P. punctatus** (Bloch) C. & V.

Olivaceous, with some small roundish spots; dorsal with a dark blotch between fifth and sixth spines; soft dorsal and caudal faintly barred; pectoral with two large blackish spots near its middle above, besides numerous pale bars and spots. Body not very slender; pectorals rather short, not reaching end of soft dorsal, slightly less than half length of body; free rays of pectoral slender; band of palatine teeth short, rather broad; maxillary $2\frac{1}{2}$ in head, not reaching eye; preorbital feebly serrated, its edge armed with two rather strong

spinous teeth, hooked backwards. Snout wide, the distance between angles of mouth scarcely less than half head; grooves between orbits behind not deep. Head 3; depth 4. D. X–12; A. 11; Lat. l. 57. West Indies, said to range northward to our coasts, but perhaps confounded with *palmipes* and *scitulus;* the specimens here described from Havana.

(*Trigla punctata* Bloch, Ausl. Fische, taf. 352; C. & V. iv, 93; Günther ii, 193.)

Page 738. Instead of *Cephalacanthus spinarella* read:

1128. C. volitans (L.) J. & G.

The specimen to which Linnæus gave the name of "*Gasterosteus spinarella*" was said to have come from India. It is therefore more likely to have been a young specimen of the one of the East Indian species (perhaps *C. orientalis* C. & V.) than of the Atlantic species *volitans.*

Page 740. After *Careproctus gelatinosus* add:

1130 (*b*). **C. reinhardi** Kröyer.

Reddish gray. Body semitransparent, covered with viscid skin. Head short and globular. Eye 5 to 6 in head. Caudal fin very slender, joined to the dorsal and anal; mouth nearly horizontal; lower jaw scarcely projecting. Ventral disk little larger than eye. Pectorals deeply emarginate, nearly as long as head, reaching anal; the lower rays exserted, appearing as a series of short twisted filaments. Distance from ventral disk to vent not more than diameter of eye; head with conspicuous mucous pores. Head $4\frac{1}{2}$; depth $5\frac{1}{2}$. D. 54; A. 45; C. 12; P. 32. Greenland to Jan Mayen. (*Collett.*)

(*Liparis gelatinosus* Reinh. Oversigt, &c. 1844, 77, not of Pallas: *Liparis* (*Careproctus*) *reinhardi* Kröyer, Naturh. Tidskr. i, 252, 1862; Collett, Norske Nord-Havs Exped. 1880, 57.)

Page 742. According to Professor Collett, *Liparis arctica* Gill is a variety of *Liparis lineata,* distinguished from the latter by its uniform coloration only. Other varieties of this species are characterized by Collett (Forh. Vid. Selsk. i, 44, 1879).

Page 746. The genus

395 (*b*).—**EUMICROTREMUS** Gill.

is probably worthy of adoption. Its single species may stand as—

1144. E. spinosus (Müller) Gill.

Page 749. After *Gobiesox strumosus* add:

1147 (*b*). **G. virgatulus** J. & G.

Olivaceous, with paler spots and fine black dots; the whole body covered with wavy, longitudinal lines of a light orange color (fading in spirits); vertical fins dusky, somewhat barred; caudal tipped with yellowish. Body rather slender; cheeks prominent; mouth reaching front of orbit; lower jaw somewhat included; teeth above in a narrow band; four of the outer somewhat enlarged; incisors of lower jaw entire; ventral disk a little shorter than head. Eyes small, 4 in head, less than half the broad interorbital space. Head 3; its width $3\frac{1}{4}$; depth 6. D. 10; A. 8. L. $1\frac{1}{4}$ inches. Pensacola, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 293.)

Page 751. No. 1149 (*b*), *Batrachus pardus* Goode & Bean, should probably be considered a distinct species. It is a deep-water form, with flabby skin.

Page 751. Instead of *Porichthys porosissimus* read:

1150. P. margaritatus (Rich.) J. & G.

Omit from the synonymy *Batrachus porosissimus* C. & V. (a species from Surinam, the identity of which with our species is not proven) and insert (*Batrachus margaritatus* Richardson, Voyage Sulphur. Fishes, 67). *P. margaritatus* appears to range from Lower California to Vancouver's Island.

Page 752. After *P. margaritatus* add:

1150 (*b*). **P. plectrodon** J. & G.

Coloration essentially as in *P. margaritatus*, but rather paler and more golden; the lines of pores and shining spots very similar. Palatines each with few teeth (4 or 5); 1 to 3 of these developed as very strong canines (usually much larger than the canines on vomer), which are strongly curved forwards and inwards (in *P. margaritatus* the palatine teeth are more numerous, subequal, small, much smaller than canines on vomer). Head $3\frac{3}{4}$; depth $5\frac{2}{5}$. D. II–37; A. 34; V. I, 2. L. 8 inches. South Carolina to Texas.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 291.)

Page 757. After *Chasmodes quadrifasciatus* add:

1154 (*b*). **C. saburræ** J. & G.

Male deep olive, with dark cross-shades; numerous pale spots on the sides which form undulating lines converging backwards; dark stripes

downward and forward from eye; top of head and upper part of dorsal fin usually with fine black spots; spinous dorsal with a median orange longitudinal band; other fins mostly dusky olive. Female with about 8 blackish cross-bands extending on the dorsal fin; the body everywhere with pale spots; fins all sharply barred with blackish and olive. Body deeper than in *C. bosquianus;* the head shorter, blunter, and the mouth notably smaller; maxillary not reaching posterior margin of eye, its length $2\frac{1}{3}$ in head; teeth occupying about half of lower jaw; height of gill-slit $3\frac{2}{3}$ in head, its lower edge opposite third ray of pectoral. A minute cirrus, shorter than pupil above each eye and each nostril. Dorsal continuous, with slender rays, the last one joined to the caudal. First two rays of anal short, thick and fleshy in the males. Head $3\frac{2}{5}$; depth 3. D. XII, 17; A. II, 18. L. 4 inches. Pensacola Bay, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 298.)

Page 757. Instead of 1155, *Isesthes gentilis* read:

1155. I. gilberti Jordan.

From the description on page 757, erase the phrases "a blue spot on the dorsal in front; males with golden stripes on lower parts of head," and insert "no sharp markings in either sex." This species is known from Santa Barbara and San Diego. It may be readily distinguished from *I. gentilis* by its stiff spines and multifid orbital tentacles, as well as by the color.

Instead of the synonomy, on page 758, substitute:

(Jordan, Proc. U. S. Nat. Mus. 1882, 349.)

Page 758. After *Isesthes gilberti* add:

1155 (*b*). **I. gentilis** (Grd.) J. & G.

Brown; males with the whole body closely mottled and blotched with darker brown, the light ground color forming reticulations around darker spots; dark spots close-set on head; lower part of side of head behind mouth with two sharply defined parallel vertical pale bars (said to be yellow in life); back with about 6 dusky cross-shades; a bluish spot on spinous dorsal in front. Female with the spots on body duller, the bands on head obsolete, and the spot on front of spinous dorsal jet black and conspicuous; fins all mottled. Body rather robust, the head very bluntly rounded in profile. Orbital tentacle *simple*, in the male one-third length of head, in the female much smaller; gill-opening not extending downward to lower edge of pectorals. Dorsal fin continuous, its spines low and flexible. Caudal free from dorsal and

anal. Head $3\frac{2}{3}$; depth 4. D. XIII, 17; A. 19; L. 4 inches. Monterey to Cape San Lucas.

(*Blennius gentilis* Girard, Proc. Acad. Nat. Sci. Phila. 1854, 149: *Blennius gentilis* Günther, iii, 217: *Blennius gentilis* Steind. Ichth. Beitr. v, 150, 1876; Jordan, Proc. U. S. Nat. Mus. 1882, 350; not *Isesthes gentilis* of the present work, page 757, which is *Isesthes gilberti*.)

Page 758. After *Isesthes punctatus* add:

1156 (*b*). **I. hentzi** (Le S.) J. & G.

Light bluish-ash, mixed with rufous, with numerous irregular black and rufous spots; dorsal black, with whitish spots; soft dorsal with 5 dark bands; ventrals blackish, with pale bands; caudal with 3 or 4 dark bands. Body little elongate; snout very short, but not vertically truncate; eyes above angle of mouth, placed high; gill-slit extending from level of base of pectoral fins to height of eye; teeth equal; dorsal slightly depressed in the middle; pectorals large; a short cirrus above each eye and a smaller one over each nostril. Depth $3\frac{1}{3}$ (in total). D. XI, 14; A. 16. Charleston Harbor, South Carolina. (*Le Sueur.*)

(*Blennius hentz* Le Sueur, Journ. Acad. Nat. Sci. Phila. iv, 363, 1825.)

1156 (*c*). **I. ionthas** J. & G.

Clear olive-green with traces of darker bars, everywhere densely freckled with small round blackish spots, smaller than the pupil, these very small on sides of head; a golden area behind eye, followed by a blackish crescent; two dark bars separated by a yellowish area below eye; fins all olive-green. Body rather deep. Head short, but less blunt than in *I. punctatus*. Mouth small, the maxillary scarcely reaching eye; teeth subequal; orbital cirrus low, scarcely longer than nasal cirrus, which is about as long as pupil. Giil-slit half head, its lower edge just below middle of pectoral. Dorsal continuous, its spines low and not very stiff; its soft rays free from caudal. Head 4; depth $3\frac{4}{5}$. D. XII, 14; A. 16. Pensacola Bay.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 299.)

1156 (*d*). **I. scrutator** J. & G.

Deep olive-green, nearly uniform; a golden blotch behind eye, followed by a dark crescent; two dark bars separated by a yellowish area below eye; fins plain dusky greenish. Body rather deep, compressed; head short, very blunt; mouth very small; teeth subequal; orbital cirri very long, reaching front of dorsal, about half length of head; gill-slit $2\frac{1}{2}$ in head, its lower edge just below middle of pectoral. Dorsal scarcely emarginate, its spines stiff; the soft rays slightly joined

to caudal; pectoral as long as head. Head $3\frac{4}{5}$; depth $3\frac{4}{5}$. D. XII, 14; A. 18. South Carolina to Texas.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 300.)

Page 759. After *Blennius fucorum* add:

1159 (*b*). **B. stearnsi** J. & G.

Light greenish olive, with irregular dark bars extending on the fins; skin finely punctate; spinous dorsal and anal dusky. Body comparatively elongate, compressed; snout short and blunt; the profile moderately decurved; mouth large, oblique, the jaws equal, the maxillary reaching slightly beyond middle of orbit, $2\frac{1}{4}$ in head; teeth $\frac{2}{2}\frac{6}{4}$; both jaws with strong curved canines posteriorly; eye moderate, equal to snout, $4\frac{1}{3}$ in head; supraorbital tentacle forked near the base, as long as snout and orbit; no nuchal filament; gill-membranes nearly free from isthmus, forming a broad fold across it. Dorsal high, continuous, its spines subequal, very slender, the highest half head; caudal distinct, $1\frac{1}{3}$ in head; ventrals not quite reaching vent. Head $3\frac{4}{5}$; depth $4\frac{2}{3}$. D. XI, 18; A. II, 21. Pensacola, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 300.)

1159 (*c*). **B. favosus** Goode & Bean.

Brownish, finely reticulated; a series of bluish blotches on sides; front and sides of head and base of pectoral with a very distinct honeycomb-like net-work of blue lines around hexagonal interspaces; top of head with small oblong blue spots; a black ocellated spot between first and second spines of dorsal; anal with oblique blue streaks. Body elongate, compressed; anterior profile moderately decurved. Mouth large, the maxillary reaching posterior border of orbit; each jaw with curved posterior canines. Supraocular cirrus very long and slender, trifid to the base, the main branch nearly as long as head; no nuchal cirrus. Gill-membranes forming a rather narrow fold across isthmus. Dorsal low, continuous, the spines very slender and flexible; the last soft ray slightly joined to caudal. Head $3\frac{2}{3}$; depth $4\frac{3}{4}$. D. XII, 18; A. II, 20. Garden Key, Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 416.)

1159 (*d*). **B. asterias** Goode & Bean.

Olivaceous, with about 6 dark cross-bars, which extend on the dorsal fin; anal and posterior half of body with numerous round, whitish, stellate spots, probably blue in life; bluish streaks from eye across the cheeks; fins vaguely marked. Body moderately elongate, compressed,

the head very blunt and deep, almost as deep as long; its anterior profile straight and nearly vertical. Mouth moderate, the maxillary reaching past front of eye, 3 in head; lower jaw with 2 short, stoutish, posterior canines; upper jaw without canines. Supraocular cirri small, fringed, about as long as pupil. Nape with a longitudinal dermal crest reaching to front of dorsal, provided with a series of about 20 filaments, the longest about as long as the eye. Gill-membranes forming a broad fold across the isthmus. Dorsal rather low, nearly continuous, beginning on the nape in front of the preopercle; spines all slender and flexible, the longest $\frac{3}{8}$ length of head. Caudal free from dorsal and anal. Head 4; depth 4. D. XI, 16; A. 19. Garden Key, Florida.

(Goode & Bean, Proc. U. S. Nat. Mus. 1882, 416.)

Page 763. In *Clinus evides*, as in *Heterostichus rostratus*, the inner edge of the shoulder-girdle is armed with an upturned, spine-like hook, not found in any other of our species. This character seems to exist in typical species of *Clinus*, and in *Cristiceps*, but not in *Labrosomus* or *Cremnobates*.

Page 764. After *Cremnobates integripinnis* add:

aa. Dorsal fins separate, the anterior highest.

1166 (*b*). **C. marmoratus** Steindachner.

Golden brown, marbled with grayish brown; two faint brown cross-bands on head; six on body, the latter extending on dorsal and anal; lower side of head, pectorals, ventrals, and caudal with numerous narrow dark cross-bands; dorsal with two small sky-blue ocellated spots, surrounded by black in the two posterior dark cross-bands. Body comparatively deep, compressed, the back somewhat arched; head pointed; mouth large, the maxillary extending to behind the eye, more than half length of head; opercle with a sharp spine; jaws equal; teeth pointed, in narrow bands, the outer larger; vomerine teeth in one row; supraocular tentacle small, about as large as nuchal tentacle; no nasal tentacle. Pectoral a little shorter than head. Dorsals separate, the second spine of first dorsal $\frac{2}{3}$ length of head, higher than second dorsal, the spines of which are about half head. Head $4\frac{2}{5}$; depth $4\frac{2}{5}$. D. III–XXVI, 1; A. II, 20; Lat. l. 38. L. $2\frac{3}{4}$ inches. (*Steindachner.*) Florida Keys (*Bean*) to Cuba.

(Steindachner, Ichth. Beitr. v, 174, pl. xii, f. 6, 1876.)

Page 774. No. 1181 should stand as

1181. C. violaceus Grd., instead of "(Ayres) Grd."

Page 793. After *Ophidium holbrooki* (which will probably be found to be identical with *O. josephi*) add:

1221 (*b*). **O. graëllsi** Poey.

Pale olive (fins without dark edging?). Head small, not very blunt; snout $4\frac{2}{3}$ in head; eye $3\frac{1}{4}$; mouth oblique, the maxillary 2 in head, reaching to posterior border of pupil; teeth small, in narrow bands, few on vomer and palatines; head naked; snout without spine; gill-rakers rather long and strong, 4 below angle of arch; opercle without spine; occiput nearly midway between origin of dorsal and front of eye. Air-bladder long and slender, tapering backwards. Head $4\frac{2}{3}$; depth 7. Cuba to West Florida.

(?Poey, Memorias Cuba, ii, 455, 1860; Jor. & Gilb. Proc. U. S. Nat. Mus. 1882, 301.)

Page 794. After *Ophidium profundorum* add:

433 (*b*).—**GENYPTERUS** Philippi.

(Philippi, Wiegmann's Archiv. 1857, 268: type *Genypterus nigricans* Philippi = *Conger chilensis* Guichenot.)

As here understood, this genus differs from *Ophidium* chiefly in the presence of a sharp spine on the opercle; most of the species have some of the palatine teeth enlarged. (γενυς, chin; πτερον, fin.)

a. Palatine teeth small.

1223 (*b*). **G. omostigma** J. & G.

Light olive, mottled with darker; fins with broad black edging; a large round, intensely black spot at the shoulder, rather larger than pupil; upper half of eye black. Body rather short, tapering rapidly backward from the occiput; snout blunt; mouth horizontal; lower jaw included; maxillary not quite reaching posterior border of orbit, $1\frac{7}{8}$ in head; teeth in jaws in broad bands; teeth on vomer and palatines quite small; eye much longer than snout, 3 in head; opercle ending in a strong spine; gill-rakers very small, 4 below angle of arch. Ventrals half length of head; scales minute, imbedded, irregularly arranged; no evident pseudobranchiæ. Air-bladder short, thick, with a large posterior foramen. Head $4\frac{1}{3}$; depth 6. L. $3\frac{1}{2}$ inches. Deep water off Pensacola, Florida.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882, 301.)

Page 796. For *Halias* Ayres read *Brosmophycis* Gill. The former name is said to be preoccupied.

Page 810:

FAMILY 120 (*b*).—CHIASMODONTIDÆ.

We are indebted to Professor Gill for the following note on the relationships of *Chiasmodon*:

"The genus *Chiasmodon* has no affinity with the *Gadidæ*, but is nearly related to some forms included by Dr. Günther in the heterogeneous group designated as the family *Trachinidæ*. It should apparently be isolated as the type of a peculiar family, which may be provisionally defined as follows:

"Acanthopterygians with a short first dorsal of slender spines; a long second dorsal and anal; ventrals normal (I, 5) and thoracic; mouth very deeply cleft; upper jaw not protractile, covered by an integument in common with the snout anteriorly; the opercular apparatus very oblique and reduced.

"This family is perhaps as nearly allied to the *Chænichthyidæ* as to any other." (*Gill* MSS.)

Page 816. Instead of *Citharichthys aramaca* read:

1256. C. pætulus (Goode & Bean) J. & G.

Instead of the synonymy in the text read:

(*Hemirhombus pætulus* Goode & Bean, Proc. U. S. Nat. Mus. Phila. 1882, 414.)

The known specimens are from Pensacola, Florida.

After *Citharichthys pætulus* add:

1256 (*b*). **C. ocellatus** (Poey) J. & G.

Light brownish; head, body, and fins everywhere finely mottled and blotched with whitish and dusky. Body moderately elongate. Mouth small, very oblique, the maxillary extending to opposite middle of eye, its length $2\frac{1}{2}$ in head. Teeth rather small, unequal, some of the upper almost canine-like, in two rows above and one below; eye 4 in head; interorbital area rather broad, concave, its width $\frac{2}{3}$ length of eye. Dorsal rather low, its anterior rays beginning on right (blind) side. Caudal rounded, its length $\frac{4}{5}$ head; left pectoral filamentous, nearly as long as head. Ventrals short, the left ventral on abdominal ridge. Lateral line without curve. Accessory scales greatly developed (as in the genus *Platophrys*, which this species much resembles). Head $3\frac{5}{6}$; depth $2\frac{1}{3}$. D. 88; A. 70; Lat. l. about 60 (pores of blind side).

(*Hippoglossus ocellatus* Poey, Mem. Cuba, ii, 314, 1860: *Hemirhombus ocellatus* Poey, Syn. Pisc. Cub. 407: ? *Hemirhombus aramaca* Günther, iv, 422.)

Page 817. After *Citharichthys sordidus* add:

1257 (*b*). **C. stigmæus** J. & G.

Olivaceous, the scales darker edged; fins dusky; all the vertical fins with a small round inky spot near the middle of each seventh to tenth ray. Body rather deep, strongly compressed; caudal peduncle short and deep; mouth moderate, the maxillary $2\frac{3}{4}$ in head, reaching past front of pupil; teeth very slender, rather long, uniserial, about $\frac{40}{30}$ on each side. Eyes large, separated by a sharp, scaleless ridge; gill-rakers moderate. Fins moderate; caudal about as long as head; pectoral $1\frac{2}{5}$ in head. Head $3\frac{3}{4}$; depth $2\frac{1}{5}$. D. 87; A. 68; Lat. l. 54 (pores). Santa Barbara, California.

(Jordan & Gilbert, Proc. U. S. Nat. Mus. 1882.)

Page 841. After *Monolene sessilicauda* add:

463 (*b*).—**BÆOSTOMA** Bean.

(Bean, Proc. U. S. Nat. Mus. 1882, 413: type *Baiostoma brachialis* Bean.)

This genus is distinguished from *Achirus* by the presence of a pectoral fin on the eyed side. From the European genus *Monochir* it differs in having the right ventral connate with the anal. (βαιος, small; στόμα, mouth.)

1298 (*b*). **B. brachiale** Bean.

Grayish, with 5 or 6 faint dark vertical lines, and with a few scattered white spots, the largest nearly as large as eye; blind side whitish. Pectoral of right side present, of several rays, $\frac{2}{5}$ length of head; right ventral of 5 rays, continuous with anal. Scales of nape, chin, and breast, much enlarged and spinulose. Interorbital width half eye. Caudal as long as head. Head more than 3; depth nearly half of total length. D. 47; A. 35. South Florida. (*Bean.*)

(Bean, Proc. U. S. Nat. Mus. 1882, 413.)

Page 845. The type of *Pterophrynoides* is *Lophius histrio* Linn., not *Chironectes bougainvillii* as stated in the text.

Page 853. After *Ostracium trigonum* add:

1316 (*b*). **O. triquetrum** L.

Dusky, closely covered with round dark spots. Body three-angled, the angles rather sharp. No spines anywhere. Carapace closed behind dorsal. Snout somewhat concave in profile. Supraocular ridges prominent, the space between them concave. Head 4; depth $2\frac{1}{5}$. D. 10; A. 10; Lat. l. 9. West Indies, north to Pensacola.

(*Ostracion triqueter* L. Syst. Nat.; Günther, viii, 256.)

Page 856. Instead of *Monacanthus broccus* read:

1322. M. hispidus (Linn.) J. & G.

(*Balistes hispidus* Linn. Syst. Nat.)

Page 861. After *Tetrodon turgidus* add:

1322 (*b*). **T. nephelus** Goode & Bean.

Very close to *T. turgidus*, of which it is the southern representative. Back and sides with pale spots, which are often surrounded by dark reticulations; dark bars on sides fainter than in *T. turgidus*, the axillary bar scarcely darker than the others. Spines of upper parts much larger, farther apart, and more distinctly stellate, than in *T. turgidus*, ceasing opposite front of dorsal and vent; less than 40 in a series from eye to dorsal. Dorsal rather larger than in *T. turgidus*. D. 8; A. 6. Georgia to Texas; very abundant. Perhaps a variety of *T. turgidus*, but thus far readily distinguishable.

(Goode & Bean, Proc. U. S. Nat Mus. 1882, 412.)

Page 863. Instead of *Diodon novemmaculatus* read:

1336. D. liturosus Shaw.

(Shaw, General Zoölogy, v, pt. 2, 436, 1804; after Lacépède.)

Page 864. After *Chilomycterus geometricus* add:

1337 (*c*). **C. reticulatus** (L.) Gthr.

Body and fins mostly covered with small round black spots; a large black blotch before and around dorsal; another on each side above gill-opening and pectoral. Spines short, compressed, the anterior root flat, much longer than the other roots except anteriorly; supraocular cirrus well developed. Head $2\frac{2}{3}$; depth $2\frac{2}{3}$. D. 12; A. 12. West Indies, north to Florida Reefs.

(*Diodon reticulatus* L. Syst. Nat.; Günther, viii, 313.)

Page 865. After *Mola rotunda* add:

487.—RANZANIA Nardo.

(Nardo, Ann. Sci. Regn. Lombard. Venet. 105, x, 1840: type *Tetrodon truncatus* Retz.)

Body oblong, the depth about half the height; skin smooth, tessellated, divided into small hexagonal scutella; otherwise essentially as in *Mola*. (Dedicated to A. Camillo Ranzani.)

1340. R. truncata (Retzius) Nardo.

Snout straight, the mouth being on the level of the eye; caudal

very short, its base straight, slightly oblique. Size much less than that of *Mola rotunda*. Pelagic; occasional off our Atlantic coast.

(*Tetrodon truncatus* Retz. Vet. Ak. Nya Handl. vi, 2, 116: *Orthagoriscus oblongus* Bloch & Schn. 1801, 511: *Orthagoriscus truncatus* Günther, viii, 319.)

Page 6:

Family BDELLOSTOMATIDÆ.

The genera *Heptatrema* and *Polistotrema* may be recognized as constituting a family (*Bdellostomidæ* Gill) distinct from *Myxinidæ*.

Page 12. We are indebted to Professor Gill for the following outline of a proposed subdivision of the *Squali*.

The existing *Squali* appear to be naturally divisible into four suborders, which differ, so far at least as the first three are concerned, in many important respects. They may be briefly diagnosed as follows:

I. OPISTHARTHRI or CYCLOSPONDYLI.

Squali with the palato-quadrate apparatus articulated or connected with the post-orbital processes of the skull; the mouth inferior; branchial apertures in increased number (6 or 7); only one dorsal fin. The *Notidanidæ* alone exhibit these peculiarities in the existing fauna.

II. PROARTHRI or ACRODONTA.

Squali with the palato-quadrate apparatus articulated by an extensive surface with the preorbital region of the skull; the mouth subterminal and the forehead declivous. The *Heterodontidæ* are the only living representatives.

III. ANARTHRI or GALEI.

Squali with the palato-quadrate apparatus not articulated with the skull; the dentigerous portions moderately developed; the mouth inferior. All the living sharks except the *Squatinidæ*, *Heterodontidæ*, and *Notidanidæ* belong to this suborder.

IV. RHINÆ.

Squali with the palato-quadrate apparatus not articulated with the skull; the dentigerous portion advanced forwards; the mouth terminal; and the pectorals with enlarged anterior basal lobes which are separated by notch-like spaces from the branchial region. The family of *Squatinidæ* is the only existing family of this suborder.

Page 22, etc. The following brief "key" will perhaps facilitate the identification of the species of *Carcharias*, which are at present known from our Atlantic coast:

a. First dorsal far behind pectoral. (*Carcharias*)..... Glaucus
aa. First dorsal close behind pectoral.
  b. Upper teeth oblique, deeply notched on outer margin. (*Platypodon* Gill.) Obscurus.
  bb. Upper teeth triangular, suberect, scarcely notched on outer margin. (*Eulamia* Gill.)
    c. Snout moderate, its length, from mouth, about equal to breadth of mouth. Cœruleus.
    cc. Snout very short, its length much less than breadth of mouth.... Platyodon.

Page 156. Professor Hay (Proc. U. S. Nat. Mus. 1882) distinguishes *Hybognathus argyritis* from the less common *H. nuchalis* by the following characters:

a. Eye small, shorter than snout; mouth small, horizontal, the lower jaw short and included; suborbitals broad, the anterior suborbital twice as long as wide; intestinal canal 7 to 10 times length of body.....NUCHALIS.

aa. Eye large, longer than snout; mouth small, oblique, the jaws equal; suborbitals very narrow, the anterior thrice as long as broad; intestinal canal $4\frac{1}{2}$ to $7\frac{1}{2}$ times length of body.....ARGYRITIS.

Page 160. After *Hyborhynchus superciliosus* add:

80 (*b*).—**TIRODON** Hay.

(Hay, Proc. U. S. Nat. Mus. 1882: type *Tirodon amnigenus* Hay.)

Pharyngeal teeth 2, 4–4, 2, compressed, not hooked, and with a broad grinding surface; lower pharnygeal bones broad, sharply curved. Otherwise as in *Hybognathus*. (τειρω, to wear away; ὀδούς, tooth.)

194 (*b*). **T. amnigenus** Hay.

Yellowish green, silvery below; upper parts dotted with black; these dots forming posteriorly a dark streak along lateral line, and one along each side of anal; fins pale. Form and appearance of *Hybognathus argyritis*. Jaws thin, the lower slightly included; mouth small, rather oblique, the maxillary not reaching front of eye; eye 3 in head, equal to snout. Lateral line decurved, complete. Dorsal inserted slightly before ventrals, a little nearer base of caudal than snout; anal small. Head $3\frac{1}{2}$; D. 8; A. 7; scales 5–38–3. Teeth 2, 4–4, 2, formed as in *Hybognathus*. Intestinal canal $3\frac{1}{2}$ times length of body. L. $1\frac{1}{4}$ inches. Pearl River, Mississippi. (*Hay*.)

(Hay, Proc. U. S. Nat. Mus. 1882.)

Page 261. Under *Elops saurus* the gular plate is about 3 times as *long* as *broad*.

Page 296. In *Hyphalonedrus chalybeius* the interorbital width is one-fourth the eye, not "4 times."

Page 297. *Coregonus couesi* is identical with *Coregonus williamsoni*, and may be suppressed.

Page 318. *Salvelinus naresi* seems to be indistinguishable from *Salvelinus oquassa*. It may therefore be erased.

Page 356. *Gymnothorax* Bloch & Schneider, is properly a synonym of *Muræna*. The oldest tenable name for the subgenus, called in the text "*Gymnothorax*," seems to be *Sidera** Kaup.

Page 358 (899). The type of the genus *Ophichthys* Ahl is, according to Poey, *Muræna annulata* Ahl, which is a species of *Pisodontophis*. Genus 170 must therefore stand as *Murænopsis* Le Sueur, and 170 (*b*) as *Ophichthys* Ahl.

Page 362. Instead of *Conger* read:

174.—LEPTOCEPHALUS Gmelin.

The two species may stand as 588, *L. conger* (L.) J. & G. and 588 (*b*), *L. caudicula* (Beau) J. & G.

Page 406. We are indebted to Mr. Joseph Swain for the following key to the species of *Menidia*:

a. Scales more or less laciniate; soft dorsal and anal scaly.
  b. Anal rays I, 14 to I, 18; D. V–I, 7; Lat. l. 48; dark points on scales of back, forming about 5 distinct streaks ..... VAGRANS.
  bb. Anal rays I, 19 to I, 21; D. IV–I, 7 or 8; Lat. l. 50 ..... LACINIATA.
aa. Scales entire; soft dorsal and anal naked.
  c. Anal fin rather short, its rays I, 15 to I, 18; depth about 5 in length.
    d. "Dorsal rays V–I, 11" ..... BERYLLINA.
    dd. Dorsal rays IV–I, 8 or I, 9.
      e. Scales rather small; Lat. l. 47; origin of spinous dorsal midway between front of eye, and base of caudal above ..... AUDENS.
      ee. Scales large; Lat. l. 38; origin of spinous dorsal midway between tip of snout and upper base of caudal ..... PENINSULÆ
  cc. Anal fin rather long, its rays I, 22 to I, 25.
    f. Body rather deep, compressed, its depth 5 in length; head $4\frac{2}{3}$; teeth rather strong ..... BOSCI.
    ff. Body elongate, its depth 6 in length; head 5 ..... NOTATA.

Page 413. The species of *Polynemus* have three anal spines.

Page 416. After *Echeneis naucrates* add:

206 (*b*).—PHTHIRICHTHYS Gill.

(Gill, Proc. Ac. Nat. Sci. Phila. 1862, 239: type *Echeneis lineata* Menzies.)

Dorsal laminæ only 10; palatines with sharp teeth; otherwise as in *Echeneis* proper. (φθεὶρ, a louse; ἰχθὺς, a fish.)

657 (*b*). **P. lineatus** (Menzies) Gill.

Disk twice as long as broad, its length $4\frac{1}{2}$ in body; lower jaw very narrow, much projecting. Head 5 in length. Body blackish, with two

* Kaup, Apodes, 1856, 70: type *Muræna pfeifferi* Bleeker = *Muræna picta* Ahl. (Latin *sidus*, a star, from the stellate spots in the typical species.)

whitish lateral bands; all the fins white-margined. D. X–33; A. 33. Tropical seas, north to South Carolina.

(*Echeneis lineata* Menzies, Trans. Linn. Soc. Lond. i, 187, 1791: *Echeneis tropica* Euphrasen, Nya Handl. 1791, 317; *Echeneis lineata* Günther, ii, 382: *Echeneis apicalis* and *sphyrænarum* Poey, Mem. Cuba, ii, 254, 255.)

Page 433. The identification of the species of *Caranx* may be facilitated by the following key, which may be substituted for the analysis given in the text:

a. Rays of soft dorsal I, 23 to I, 27; teeth subequal, or the outer a little enlarged.
  b. Shoulder-girdle below with a fleshy projection, in front of which is a cross-furrow; body elongate; depth 3½ in length. (*Trachurops* Gill.)
    CRUMENOPHTHALMUS.
  bb. Shoulder-girdle without peculiar appendage.
    c. Maxiliary broad; dorsal and anal usually more or less elevated anteriorly, or falcate; head large, more than ¼ length.
      d. Scutes 40 to 50. (*Paratractus* Gill.)
        e. Pectoral little longer than head; depth 3 in length.....CHRYSUS.*
        ee. Pectoral considerably longer than head; depth 3½ in length...CABALLUS.
      dd. Scutes (developed) about 30. (*Carangoides* Bleeker.)
        f. Length of pectoral equal to depth of body, which is 3 in length....CIBI.
        ff. Length of pectoral less than depth of body, which is 2⅓ in length. (Young of *cibi?*).....BEANI.
    cc. Maxillary very narrow; dorsal and anal scarcely elevated in front; head small, not one-fourth length of body; lateral line very strongly arched; scutes about 50. (*Carangops* Gill).....AMBLYRHYNCHUS.
aa. Rays of soft dorsal I, 20 to I, 22; body deep; teeth of the outer row enlarged, sometimes forming feeble canines; scutes 30 to 35. (*Caranx.*†)
  g. Breast entirely scaly; opercular spot very small.....FALLAX.
  gg. Breast naked, except a small median area; opercular spot large.
    HIPPOS.

Page 443. No. 699 should be—

699. T. glaucus (Bloch) C. & V.

(*Chætodon glaucus* Bloch, Ichth. vi, 76, pl. 210.)

Page 489. After *Ammocrypta pellucida* add:

762 (*b*) **A. vivax** Hay.

Pellucid; sides with 10 dusky blotches, most distinct posteriorly; 14 similar blotches along back; top of head speckled; fins with a few dots. Form of *A. pellucida*. Maxillaries reaching front of orbit; teeth rather weak; eye 3½ in head, equal to snout; cheeks and opercles scaly. Body covered with small, strongly ctenoid scales, except the regions immediately before and behind bases of paired fins. Spinous and soft

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* *Scomber crysos* Mitchill, Trans. Lit. & Phil. Soc. N. Y. I, 424, 1815 = *Caranx pisquetus* C. & V.

† = *Carangus* Girard. The proper type of *Caranx* is *Scomber carangus* Bloch = *Scomber hippos* L. The word *Caranx* (*Carangue*) is a corruption of the Portuguese name *Acarauna*.

dorsals about equal, their longest rays half head, about equal to the interspace between them. Anal short and high, half higher than long, its base not quite half head, its spine weak; pectorals and ventrals reaching a point midway between base of pectorals and anal. Head 4; depth 7. D. XI–10; A. I, 9; scales 6–65–10. L. $1\frac{2}{3}$ inches. Pearl River, Mississippi. (*Hay.*)

(Hay, Proc. U. S. Nat. Mus. 1882.)

Page 490. After *Ioa vitrea* add:

764 (*b*). **I. vigilis** Hay.

Pellucid, with about 10 quadrate dark blotches along the back and as many along lateral line, the last 4 or 5 of these largest; a small distinct black spot at base of caudal; head dusky above, its sides plain. Body slender, the caudal peduncle deep and compressed, twice as long as deep. Head long, pointed; mouth large, the jaws equal, the maxillaries reaching front of pupil; teeth recurved; opercular spine well developed. Head naked; eye large, 3 in head, longer than snout. Dorsal fins similar, longer than high; anal longer than high, somewhat smaller than second dorsal, its spines slender, half as long as soft rays. Posterior portion of body densely scaled; anterior portion apparently with a few scales above lateral line, none below; lateral line not developed on the last 5 or 6 scales. Head $3\frac{3}{4}$; depth 6. D. X—12; A. II, 10; Lat. l. about 60. L. $1\frac{1}{3}$ inches. Pearl River, Mississippi. (*Hay.*)

(Hay, Proc. U. S. Nat. Mus. 1882.)

Page 494. *Vaillantia chlorosoma* is identical with *V. camura.*

Page 544. Instead of *Priacanthus macrophthalmus* read:

858. P. arenatus C. & V.

(Cuv. & Val. iii, 101, 1829. The original *Anthias macrophthalmus* Bloch. is a different species.)

Page 549. *Lutjanus blackfordi*, the Red Snapper, seems to be identical with *L. campechianus.* It ranges southward to Aspinwall.

Pages 534, 553. The *Perca formosa* of Linn. is the *Serranus fasciularis* of C. & V., and not the *Diabasis formosus* of the text. The former should, therefore, stand as *Serranus formosus* (L.) J. & G. and the latter as *Diabasis plumieri** (Lac.) J. & G.

Page 538 (918). The description of *Trisotropis brunneus*, on page 538, should be canceled, the species not being known from our coast. To

* *Labrus plumieri* Lacépède, Hist. Nat. Poiss. iii, 480, 1802.

the description of our species, *T. stomias* G. & B., on page 918, add: Head 3; depth 4; Lat. l. about 140. Body rather slender, compressed. Scales smooth, with many accessory scales.

Page 557. The second interspinal bone of the anal is enlarged and pen-shaped in the species of *Stenotomus* and *Calamus*. It is normal, and not pen-shaped, in the typical species of the groups called *Pagrus*, *Sparus* (*Chrysophrys*), *Pagellus*, as well as in *Diplodus*, *Archosargus*, and *Lagodon*.

Page 557 (929). Our suggestion, on page 929, that *Argyrops* Sw. should be substituted for *Stenotomus*, is premature. The species called *Argyrops* (*spinifer*, *ehrenbergi*, *auriga*) bear a strong resemblance to *Stenotomus caprinus*, and according to Steindachner (Beitr. zur Kenntn. Fische Afrika's, ii, 3, 4, 1882) their anterior teeth are somewhat compressed. Professor Doderlein has, however, published (Giorn. Scienz. Nat. Econ. Palermo, xiv, 1879) photographs of the dentition of *Pagrus ehrenbergi* C. & V., from which it appears that these teeth are really robust canines and not incisors. Dr. H. E. Sauvage, who has kindly examined the specimens of "*Pagrus spinifer*" in the Paris Museum, has lately informed us that the dentition of this species is essentially that of *Sparus pagrus*, and different from that of *Stenotomus*.

Page 559. The description in the text of *Diplodus caudimacula* was drawn from young specimens of *D. holbrooki*, which may, however, prove to be scarcely distinct from the true *caudimacula* of Cuba.

Page 560. Instead of *Pimelepterus* read:

289.—CYPHOSUS Lacépède.

(*Kyphosus* Lac. Hist. Nat. Poiss. iii, 115, 1802: type *Kyphosus bigibbus* Lac. *κυφος*, gibbons.)

887. C. bosqui (Lac.) J. & G.

Page 630. Instead of *Philypnus* read:

339.—GOBIOMORUS Lacépède.

(Lacépède, Hist. Nat. Poiss. ii, 589, 1800: type *Gobiomorus dormitor* Lac. = *Platycephalus dormitator* Bl. & Schn. 1801: *Gobius*; *ὁμορος*, adjoining. *Gobiomoroides* Lac. is not a synonym of *Eleotris*.)

Page 882. Instead of *Paralichthys ophryas* read:

1265. P. ocellaris (Dek.) J. & G.

Cape Cod to Florida; generally common.

(*Platessa ocellaris* Dekay, New York Fauna, Fishes, 1842, 300: *Pseudorhombus ocellaris* Günther, iv, 430.)

Page 426. The dorsals in *Scomberomorus concolor* are contiguous, as in *S. maculatus*.

Page 438. Under No. 692, for "Akerly" read "Mitchill."

Page 447. Instead of *Oligoplites occidentalis* read, 707. *O. saurus* (Bl. & Schn.) J. & G. (= *Scomber saurus* Bl. & Schn. 32). The original *Gasterosteus occidentalis* L. (Syst. Nat. Ed. X) is not this fish, and is unidentifiable.

Page 519. *Pœcilichthys butlerianus* is identical with *P. barratti*.

Page 534. Instead of *Serranus trifurcus* read, 837. *S. philadelphicus* (L.) J. & G. (= *Perca philadelphica* L. Syst. Nat. Ed. X).

Page 539 (918). Nos. 847 and 850 (*c*) should apparently stand as *Epinephelus impetiginosus* (Müller & Troschel) Poey, and as *Epinephelus apua* (Bloch) Goode & Bean, respectively. The prior names *punctatus*, *atlanticus*, and *guttatus* are of very doubtful application.

Page 553 (924). Instead of *Diabasis chrysopterus* read, 873. *D. aurolineatus* (C. & V.) J. & G. The original *Perca chrysoptera* L. is some other fish, probably unidentifiable.

Page 603 (936). No. 946 (*P. radiatus* of the text) should stand as *Platyglossus cyanostigma* (C. & V.) Gthr., while No. 947 (*bivittatus*) should be *P. radiatus* (L.) J. & G. The latter species is the original *Sparus radiatus* L.

Page 605. Instead of *Xyrichthys vermiculatus* read, 951. *X. lineatus* (Gmel.) J. & G. (*Coryphæna lineata* Gmelin, Syst. Nat. 1195). No. 952. *X. lineatus* C. & V. should be omitted, as not found on our coasts.

Page 616. Under *Pomacanthus arcuatus* read:

D. X, 29; 65 scales between scapula and caudal; 85 to 90 in a series above lateral line.

Page 690. The "Northern variety" of *Icelus notospilotus* seems to be a distinct species—*I. fenestralis* Jor. & Gilb. It has a small pore behind fourth gill.

Page 916. The generic name *Brachyrhinus* is preoccupied. For it may be substituted:

273 (*b*). **PARANTHIAS** Guichénot.

(Guichénot, Ann. Soc. Linn. Maine-et-Loire, x, 1868: type *Serranus furcifer* C. & V.)

Page 945. To the account of *Gobius encæomus* add:
Head 4; depth $5\frac{3}{4}$. D. VI–11; A. 12; Lat. l. 37.

Page 104. Instead of *Amiurus catus* read, 98. *A. nebulosus* (Le S.) Gill. The *Silurus catus* L. is not this fish, and is not identifiable.

Page 358 (899, 969). The proper type of the genus *Ophichthys* Ahl. (*De Muræna et Ophichtho* 1789) is *Muræna ophis* L. The name *Ophichthys* should therefore be used as on page 358, for the species with sharp teeth. Those with granular teeth (*Pisodontophis* Kaup) should be called *Ophisurus* (Lacépède, ii, 195, 1800: type *O. ophis* Lac., *nec* L.). Our species should stand as, 584 (*b*). *Ophisurus acuminatus* (Gronow) J. & G.

Page 440. The caudal peduncle in "*Selene*" *setipinnis* is armed as in *Caranx*, but more feebly.

Page 442. Instead of *Trachynotus ovatus* read, 697. *T. rhomboides* (Bloch) C. & V. (= *Chætodon rhomboides* Bloch, Ichthyol. pl. 209.) The true *T. ovatus*, from the East Indies, is thought by Lütken to be specifically different.

Page 532 * No. 835 may stand as *Polyprion cernium* Val. *Epinephelus oxygeneios* is said to be a species of *Oligorus*.

Page 736. Instead of *Prionotus evolans* read, 1126. *P. sarritor* Jor. & Gilb.; and instead of subsp. *lineatus* read, 1126 (*b*). *P. strigatus* C. & V. *Trigla evolans* L. is not identifiable, and *Trigla lineata* Mitchill was an erroneous identification of *T. lineata* Bloch.

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*The corrections suggested on this page and the preceding have not been introduced into the table of contents.

Bayerische
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INDEX.

A.

Abadejo 538
abbotti (Osmerus) 294
(Syngnathus) 384
Abeona 587
Abramis 249
acadian (Cottus) 685
acadianus (Glyptocephalus) 838
(Hemitripterus 685
Acantharchus 468
Acanthias 16
acanthias 16, 17
Acanthochætodon 615
Acanthocottus 700
Acantholebius 641
Acanthonotus 370
Acanthopteri 397
Acanthopterygii 397
Acanthosoma 865
Acanthostracium 854
Acanthuridæ 616, 880
Acanthurus 617, 941
acervum 426
achigan 485
Achirus 841
achirus 842
Acipenser 85
Acipenseridæ 84
acipenserinus 730, 731
ackleyi 878
Acomus 124
acoupa 570
Acrochilus 150
Acronuridæ 616
Acronurus 617
Actinochir 741
aculeatus (Chrysophrys) 557
(Clinus) 777
(Gasterosteus) 393, 395
(Halieutichthys) 851
(Lophius) 851
(Sparus) 557, 929
(Stichæus) 777
acuminata (Muræna) 899
(Sciæna) 573
acuminatus (Eques) 573
(Grammistes) 573
(Ophichthys) 899
(Ophisurus) 899
(Pareques) 573
acuta (Myliobatis) 51
(Perca) 524
acutirostris (Acipenser) 86, 87
(Anguilla) 361
adamantinus 92, 880
adarondacus 317
Adinia 335, 891, 892
adinia (Fundulus) 335, 891
adspersus 599
ægliſinus 803
Ælurichthys 110
æneus (Centrarchus) 467
(Cottus) 701
(Pimelodus) 102
ænigmaticus 620
æpyptera 10
æsculapius 888
æsopus 493
æstivalis (Ceratichthys) 216
(Clupea) 267
(Gobio) 216
(Pomolobus) 267
Aëtobatis 50, 879
afer (Gymnothorax) 895
affine (Siphostoma) 383, 904, 906
affinis (Atherinops) 409
(Atherinopsis) 409, 410
(Carapus) 791
(Caulolatilus) 626
(Clinostomus) 232
(Gambusia) 345, 346
(Gila) 229
(Heterandria) 346, 894
(Leuciscus) 232
(Lucania) 343
(Syngnathus) 383
(Thynnus) 430
afra (Muræna) 895
agassizi (Acipenser) 87
(Amphistichus) 592
(Chologaster) 325
(Hyperprosopon) 592
(Pimephales) 159
agilis 807
Agnus 628
Agonidæ 722, 880
Agonus 728
Agosia 208
aggregatus 590
Aguja blanca 420
Aguja de casta 420
Aigrette 601
aigula 601
Ailurichthys 110

	Page.
ailurus	105
alalonga	428, 429
alascanus	415
alatunga	429
albacora	429
albicauda	417
Albicore	428, 429, 430
albidum (Moxostoma)	141
albidus (Aminrus)	107
(Gadus)	809
(Ictalurus)	107
(Labrax)	530
(Merlucius)	809
(Pimelodus)	107
(Ptychostomus)	142
(Tetrapturus)	420, 909
albigutta	823
albirostris (Syngnathus)	906
(Corythroichthys)	906
Albula	258
albula (Mugil)	403, 404, 908
Albulidæ	258
albulus (Brytus)	482
(Lepomis)	481
album (Hæmulon)	924
(Moxostoma)	139
Alburnellus	185, 200
Alburnops	185, 189
Alburnus	251, 884
alburnus (Menticirrus)	577, 578, 933
albus (Coregonus)	299
(Diabasis)	924
(Ptychostomus)	139
alectrolophus (Anoplarchus)	771
Alepidosauridæ	274
Alepidosaurus	275, 276, 888
alepidotum (Gobiosoma)	638
alepidotus (Chætodon)	451
(Gobius)	638
(Stromateus)	451, 914
Alepocephalidæ	257
Alepocephalus	257
Alewife	267
Alfione	596
Algansea	244, 245
Algoma	155
aliciæ	238
Alilonghi	428
alipes	321
Alligator-fish	730
Alligator Gar	92
alliteratus	430
All-mouth	844
Allosomus	301
Alopecias	27
Alopias	27
Alopiidæ	26
Alosa	267
alosoides	259, 260
alta (Cliola)	163
alternans	938
altipinnis	195
altivelis	618
altus (Bubalichthys)	116, 883
(Hudsonius)	164
altus (Priacanthus)	545
alutaceus	150
Alutera	858
alutus	931
Alvarius	514, 522
alveata	876
alvordi	697
Alvordius	500
amabilis	195
amara (Algoma)	156
amarus (Hudsonius)	171
(Hybognathus)	156
ambassis	558
Amber-fish	444
Amblodon	567
Ambloplites	466
amblops	214
Amblyopinæ	630
Amblyopsidæ	323
Amblyopsis	324
amblyopsis (Culius)	944
amblyrhynchus	431, 912, 970
Ameiurus	102
americana (Lucioperca)	525
(Morone)	531
(Morrhua)	804
(Perca)	524, 531
(Raia)	41
(Scorpæna)	685
(Stilbe)	250
(Tautoga)	600
americanus (Abramis)	250
(Acanthias)	17
(Ammodytes)	414, 909
(Amphiprion)	532
(Apogon)	563, 930
(Apogonichthys)	564
(Carcharias)	27
(Cyprinus)	250
(Enchelyopus)	799
(Eques)	932
(Esox)	352
(Hemitripterus)	685
(Hippoglossus)	819
(Histiophorus)	421, 909
(Labrax)	551
(Leuciscus)	250
(Leucosomus)	250
(Lophius)	844
(Luxilus)	250
(Notemigonus)	250
(Odontaspis)	28, 874
(Petromyzon)	11
(Phycis)	799
(Plargyrus)	250
(Pleuronectes)	837
(Roccus)	530
(Squalus)	28
(Stilbius)	250
amethystinus	317
Amia	94, 563
amia (Caranx)	911
Amiatus	94
Amiidæ	92
Amitra	739

	Page.
Amiurus	102, 881
Ammocœtes	9, 867, 868
Ammocrypta	488, 970
Ammodytes	414, 909
Ammodytidæ	414
amnigenus	968
Amphiodon	260
amphiodon	260
Amphioxus	3
Amphistichus	590, 936
amplus	420, 909
ampullaceus	365
Anablepinæ	327
Anacanthini	397, 783
Anacanthini pleuronectoidei	813
anagallinus	479
anale (Ditrema)	591
analis (Amphistichus)	591
(Centridermichthys)	717
(Hyperprosopon)	591
(Hypocritichthys)	591
(Oligocottus)	717
(Orthagoriscus)	866
(Saurus)	889
analogus	939
analostana	179
Anarrhichadidæ	754
Anarrhichas	781
Anarrhichthys	782
Anarthri	967
anceps	506
Anchisomus	860
Anchovy	271, 272
Ancylopsetta	821, 825
Angel-fish	612, 613, 615
Angel Shark	35
angelus	35
Angler	844
anglorum	747
Anguilla	361
anguilla (Muræna)	361
anguillaris (Blennius)	778, 784
(Enchelyopus)	784
(Lumpenus)	777
(Stichæus)	778
(Zoarces)	784
Anguillidæ	357
Anisarchus	776
Anisotremus	552, 923
anisurum	136, 141
annæ	727
annularis (Julis)	602
(Pomoxys)	464
annulata (Melanura)	350
annulatus (Antennarius)	846
anomala (Dekaya)	626
anomalum (Campostoma)	149
anomalus (Caulolatilus)	625, 626
(Rutilus)	148, 149
Anoplagonus	724
Anoplarchus	770
Anoplopoma	649
anoplus	629, 941
Antaceus	85
Antennariidæ	845

	Page.
Antennarius	845
anticus	246
antillanus	551
antiquorum (Hippocampus)	386, 906
(Pristis)	37, 875
antistius (Chænobryttus)	467
antoniensis	105
Apeltes	396
apeltes (Gasterosteus)	396
Aphoristia	842
Aphredoderidæ	460
Aphredoderus	460
apiatus	476
apicalis	970
Aplesion	514
Aplocentrus	880
Aplodinotus	567
Apocope	209
Apodes	354
Apodichthys	769
Apogon	563, 930
Apogonidæ	563
Apogonichthys	931
Apomotis	472, 473
apos	766
appendiculatus	381
appendix (Ammocœtes)	867, 868
(Labrus)	480
(Petromyzon)	868
(Pomotis)	477, 480
Aprion	24
aprion (Diapterus)	935
(Gerres)	935
Aprionodon	24, 874
apua	920, 973
apus	766
aquilensis	474, 480
aquosus	816
arabatsch	309
aræopus	127
aramaca	816, 817, 964
Archoplites	465
Archosargus	558, 929, 971
arctica (Liparis)	742, 957
arctifrons (Calamus)	927
(Citharichthys)	818
Arctozenus	278
arcuatum (Ditrema)	592
(Hæmulon)	553
(Hyperprosopon)	592
arcuatus (Amphistichus)	591
(Chætodon)	616
(Pomacanthus)	616
arcturus	319
ardens (Catostomus)	128
(Hypsilepis)	198
(Minnilus)	198
ardesiaca (Gila)	235
ardesiacus (Lepomis)	480
(Squalius)	235
arenatus (Priacanthus)	971
(Rhinichthys)	885, 886
arge (Alburnellus)	202
argentata (Couchia)	797
(Motella)	797

	Page.
argentatus (Astyanax)	255
(Plargyrus)	187
(Tetragonopterus)	255
argentea (Hypsiptera)	798
(Selene)	439, 440
(Sphyræna)	411
argenteum (Ditrema)	593
(Hyperprosopon)	592
argenteus (Ammocœtes)	10
(Amphistichus)	593
(Eucinostomus)	584, 935
(Gerres)	584, 934
(Holconotus)	936
(Ichthyomyzon)	10
(Leuciscus)	222
(Pagrus)	556
(Petromyzon)	9, 10, 867, 868
(Sparus)	556
(Tetragonopterus)	255
Argentina	295
argentissimus	253
argentosa	157
Argyrea	406
argyreiosus	223
Argyreus	206
argyreus (Fario)	307
Argyriosus	439
argyriosus	222
argyritis	156, 968
argyrolenca	571
Argyrops	829, 972
argyrops	557, 558, 929
argyrosoma (Embiotoca)	597
Argyrosomus	300
argyrosomus (Damalichthys)	597
Argyrotænia	415, 909
ariommus	194
Ariopsis	110
Arius	109, 882
Arlina	491
arlingtonia	345
armatus (Aspidophorus)	728
(Centridermichthys)	714
(Leptocottus)	713
artedi	300, 301
Artedius	689
artesiæ	516
arundinaceus	385
Ascelichthys	686
asper (Centridermichthys)	695
(Cottopsis)	695
(Cottus)	695
(Hexagrammus)	641, 643, 949
(Pleuronectes)	835
aspera (Limanda)	835
aspera (Uranidea)	694
Aspicottus	710
Aspidophoroides	724
Aspidophorus	728
asprella	490
asprigenis (Pœcilichthys)	518
aspro	501
Astatichthys	514
asterias (Blennius)	961
(Mustelus)	870

	Page.
Asternopteryx	769
astori	8, 57
Astronesthes	287
Astroscopus	628, 941
Astyanax	255
Atheresthes	820
Atherina	405
Atherinichthys	406
Atherinidæ	404
Atherinoides	406
atherinoides (Chriodorus)	903
(Notropis)	202
Atherinops	409
Atherinopsis	409
atkinsii	395
atlanticus (Elacate)	419
(Epinephelus)	918, 973
(Megalops)	887
(Sparus)	540
Atractoperca	535
Atractoscion	579, 933
Atractosteus	92, 880
atraria (Perca)	534
(Siboma)	241, 886, 887
atrarius (Centropristis)	534
(Pimelodus)	105
(Serranus)	533, 916
(Squalius)	241, 886
atricauda	842
atrilatus	340, 892, 894
atripes (Ditrema)	595
(Lythrurus)	197
(Minnilus)	197
atripinnis (Arlina)	496
(Goodea)	348
(Ulocentra)	495
atromaculata (Estrella)	492
atromaculatum (Boleosoma)	492
atromaculatus (Cyprinus)	221
atronasus (Rhinichthys)	208, 885
atropurpureus	771
atrovirens	662
attenuatus	293
Auchenopterus	764
auctorum	555
audens	908, 969
auliscus	905, 906
Aulorhynchidæ	391
Aulorhynchus	391, 908
Aulostoma	390
Aulostomatidæ	390
aurantiacus (Balistes)	858
(Ceratacanthus)	858
(Cottogaster)	505
(Hadropterus)	505
(Hypohomus)	505
aurata (Cliola)	175
(Moniana)	175
auratus (Carassius)	253
(Cyprinus)	253
(Gadus)	804
(Mullus)	931
aurea (Clupea)	270
aureolum (Moxostoma)	140
aureolus (Catotomus)	140

aureolus (Xenotis) ... 478
aureovittata (Seriola) ... 444
aureus (Ammocœtes) ... 867, 868
(Clupanodon) ... 270
(Eupomotis) ... 483
(Fundulus) ... 340
(Haplochilus) ... 340
(Sparus) ... 483
auriculatus ... 670, 671
auriga ... 542, 920
aurita (Ichthelis) ... 478
auritus (Labrus) ... 477, 478
(Lepomis) ... 477, 478
(Pomotis) ... 483
aurolineatus ... 925, 973
aurora (Abeona) ... 588
(Catostomus) ... 127
(Fario) ... 315
(Salmo) ... 315
aurorubens ... 549, 550
australe ... 154
austrinum ... 135
Auxis ... 424
avocetta ... 367
axillaris ... 706
ayresi (Parophrys) ... 831
(Petromyzon) ... 8
Ayresia ... 611, 989

B.

bacalaus ... 636
Bachelor ... 464
badius ... 885, 886
Bæostoma ... 965
Bagara ... 578
Baione ... 316
Baiostoma ... 965
bairdi (Alepocephalus) ... 257
(Cottus) ... 697
(Macrurus) ... 812
(Salmo) ... 320
(Salvelinus) ... 320
(Uranidea) ... 697
bairdianum ... 905, 906
Bairdiella ... 570
bajonado ... 926, 927
Balao ... 902
balao ... 902
balias (Chirus) ... 645
Balistes ... 854
Balistidæ ... 854
balteatus (Eques) ... 932
(Richardsonius) ... 251
Barb ... 577
barbatum (Echiostoma) ... 286, 287
barbatus (Mullus) ... 565, 931
(Siphagonus) ... 725
Barbero ... 617
bardus ... 122
Bar-fish ... 465
barkani ... 727
Barndoor Skate ... 42
Barracuda ... 410
barracuda (Sphyræna) ... 412
barratti ... 519, 973
Bashaw ... 102
Basilichthys ... 406
Basking-shark ... 30
Bass ... 484, 528
Bastard Halibut ... 821
Bastard Snapper ... 549
Bat-fish ... 51, 738, 849
Bathymaster ... 622
Bathymasterinæ ... 619
Batrachidæ ... 750
Batrachus ... 750, 958
Bayou Bass ... 484
Bay shark ... 60
Bdellostoma ... 5, 867
Bdellostomatidæ ... 967
beadlei ... 109
beani (Ammocrypta) ... 489
(Caranx) ... 436, 912, 970
(Limanda) ... 835
(Pleuronectes) ... 835
beckwithi ... 176
belizanus ... 345
bellicus ... 212
Bellows-fish ... 388, 844
bellus ... 199
Belone ... 372
belone (Tetrapturus) ... 909
Belonesox ... 344
Belonopsis ... 366
bendirei ... 696
Benthodesmus ... 910
berlandieri ... 403
bernardini ... 128
Berycidæ ... 457
beryllina ... 408, 909, 969
biaculeatus ... 395, 396
bicolor (Algansea) ... 246
(Ammocœtes) ... 868
(Leuciscus) ... 246
(Leucus) ... 246
(Squalius) ... 237
(Tigoma) ... 237
bicornis (Icelus) ... 693, 952
Bielaya Ryba ... 307
bifrenata ... 162
Big-eye ... 544
Big-eyed Herring ... 260, 261
Big-eyed Scad ... 434
biguttatus (Ceratichthys) ... 212
(Cochlognathus) ... 161
(Semotilus) ... 211, 212
bilinearis ... 809
bilineata (Lepidopsetta) ... 834
(Platessa) ... 834
bilineatum (Pristipoma) ... 552
bilineatus (Pleuronectes) ... 833, 834
(Pomadasys) ... 552, 923
Bill-fish ... 91, 374, 375, 420
billingsiana ... 177
bilobus ... 720
bimaculata (Ethcostoma) ... 500
bimaculatus (Chætodon) ... 940
(Pseudoxiphophorus) ... 344
(Sarothrodus) ... 940
(Xiphophorus) ... 344

	Page.
binoculata	43, 878
bipinnulatus	446, 913
birostris	52, 53, 880
bison (Aspicottus)	710, 711
(Carpiodes)	119
(Enophrys)	710
(Ictiobus)	883
bispinosus (Gasterosteus)	396
(Myliobatis)	51
bisus	425
bivittatus (Hybopsis)	196
(Labrus)	937
(Minnilus)	195
(Platyglossus)	936, 973
Black Angel	941
Bass	484
Black-fin	301
-fish	533, 600
blackfordi	549, 921, 971
Black Grouper	538, 540
Grunt	553
Horse	120, 121
Black-nosed Dace	206
Perch	595
Sea-Bass	531, 533
Blacksmith	611
Black Sturgeon	87
Blakea	763
blanchardi	761
Blanquillo	623, 625, 626
Blennicottus	717, 718
Blenniidæ	753, 880
blennioides	497, 502
blennioperca	497
Blenniops	765
Blennius	759, 961
blennius (Alburnops)	189, 193
(Minnilus)	193
Blennophis	756
Blenny	753, 759
Blepharichthys	438
Blepharis	438
Blepsias	719
Blind Cat	102
Blind-fish	323
Blob	696
Blower	861
Blue-back	267
-back Salmon	308
-back Trout	318
Blue Cod	646
Blue-fin	301
-fish	447, 448, 560, 580, 603
Blue Mullet	139
Perch	594, 599
Pike	525, 526
Shark	22
Boccaccio	656
Bodianus	541, 602
bodianus (Cossyphus)	602
Boleichthys	514, 519
boleoides	699
Boleosoma	491
boleosoma (Gobius)	946
bolli	881

	Page.
bombifrons	478, 479
bonariensis	445, 913
bonasus	116
Bone-Dog	16
Bone-fish	258
Bonito	427, 428
Bonnet-headed Shark	25
Bony-fish	269
boops	436
borea (Lucioperca)	526
borealis (Alepidosaurus)	276
(Amiurus)	108
(Arctozenus)	278
(Caulopus)	276
(Læmargus)	15
(Maurolicus)	284
(Notorhynchus)	34
(Paralepis)	278
(Pimelodus)	108
(Scopelus)	284
(Sphyræna)	411
(Sudis)	278
Boreocottus	706
Boreogadus	807
Borer	5
boreum (Stizostedium)	526
boreus (Esox)	353
bosci (Atherina)	407
(Gobiosoma)	948
(Gobius)	638, 948
(Leuciscus)	250
(Menidia)	407, 908, 909, 969
(Pimelepterus)	561
(Seriola)	445, 913
bosqui (Cyphosus)	972
bosquianus	756, 757
bostoniensis (Anguilla)	361
(Catostomus)	127, 130
(Muræna)	361
Bothragonus	728, 956
Bothrolæmus	441, 442
Bothus	815
boucardi	246
bouvieri	315
bovinus	329, 890
Bow-fin	94
bowmani	187
brachiale	965
brachyacanthus	881
Brachyistius	588, 589, 936
Brachyopsis	726, 955
brachypoda	394
Brachyprosopon	838
brachyptera (Echeneis)	417
brachypterus (Remoropsis)	417
(Thynnus)	429
(Zygonectes)	341, 890
brachyrhynchus	86
Brachyrhinus	916, 973
brachysomus	927
brachyurus	72
Brama	455, 915
Bramidæ	455
Branch Herring	267
Branchiostoma	3, 867

	Page.
Branchiostomatidæ	2
brasiliensis (Atherina)	408
(Atherinichthys)	408
(Esox)	902
(Hemirhamphus)	902
(Menidia)	408, 909
(Mugil)	403
(Narcine)	877
(Torpedo)	877
Bream	250, 482, 558
brevicauda (Pomoxys)	465
(Salmo)	315
breviceps (Pomotis)	478
(Ptychostomus)	141
brevipinna (Scymnus)	15
(Somniosus)	14, 15
brevipinne (Boleosoma)	492
(Ditrema)	589
brevirostris (Acipenser)	87
(Carcharias)	61
(Chasmistes)	132
(Hippocampus)	386
(Histiophorus)	909
(Hypoprion)	61
(Scomberesox)	375
(Syngnathus)	384
(Thynnus)	430
brevis	70
Brevoortia	269
Broad-shiners	449
broccus	856, 966
Brook Stickleback	394
Sucker	129
Trout	320
brosme	802, 803
Brosmius	802
Brosmophycis	795, 963
Brotulidæ	794
broussoneti	576
browni (Achirus)	841
(Atherina)	273
(Hemirhamphus)	903
(Solea)	841
(Stolephorus)	273, 888
(Vomer)	440
brunneus (Amiurus)	103
(Serranus)	538
(Trisotropis)	538, 918, 971
bryoporus	264
Bryttus	472
Bubalichthyinæ	112
Bubalichthys	115, 881, 882
bubalina	176
bubalis (Cottus)	701
bubalus (Amblodon)	114
(Bubalichthys)	116
(Catostomus)	116, 883
(Ichthyobus)	114
(Ictiobus)	114, 882, 883
buccata	204
bucco	138
Buffalo Cod	646
Buffalo-fish	113, 115
bufo	681
Bug-fish	269
bullaris	222
Bull-head	104, 696
Bullon	938
Bull Trout	319
Burbot	801
burgall	599
Burnstickle	395
butlerianus	519, 973
Butter-fish	451, 541, 766, 767
Butterfly Ray	46
Bythites	795

C.

caballa (Cybium)	427
(Scomberomorus)	427
caballerote (Lutjanus)	92
caballus	435, 970
Cabezon	714
Cabrilla	535, 536, 539
Cæsiosoma	562
Calamus	555, 925, 972
calamus (Chrysophrys)	926
(Pagellus)	926
calcarata	952
Calico Bass	465
californica (Alausa)	266
(Morrhua)	806
(Squatina)	35
(Torpedo)	39, 876, 877
californicus (Exocœtus)	379
(Gadus)	806
(Hippoglossus)	821
(Mustelus)	20, 59, 870
(Myliobatis)	51
(Paralichthys)	821
(Pseudorhombus)	821
(Stereolepis)	531
(Uropsetta)	821
californiense (Siphostoma)	384, 906
californiensis (Atherinichthys)	409
(Atherinopsis)	409, 410
(Cyprinodon)	330
(Ophisurus)	359, 898
(Otolithus)	579
(Scorpis)	562
(Syngnathus)	384
(Typhlogobius)	639
(Xenichthys)	547, 920
(Xenistius)	920
callarias (Gadus)	804
(Salmo)	320
Callechelys	897
Calliodon	606
calliodon (Liparis)	743
callipteryx	149
callisema	173
callisoma	898
callistia	181
calliura (Codoma)	178
(Cyprinella)	178
Calliurus	467, 484
calliurus (Ioglossus)	949
callyodon (Cyclopterus)	743
Calycilepidotus	714
calva	94

	Page.
Camarina	560
campbelli	320
Campbellite	464
campechianus	921, 971
camperi	374, 375
Campostoma	148
Campostominæ	145
Campylodon	370
camtschaticus	868
camura (Boleosoma)	494
(Vaillantia)	494, 971
camurus (Nothonotus)	506
(Pœcilichthys)	507
canada (Elacate)	418, 419, 909
canadense (Stizostedium)	526
canadensis (Lucioperca)	526
(Salmo)	320
Candle-fish	292
canicula	869
caninus (Caranx)	438
(Lachnolæmus)	601
(Pagellus)	927
canis (Galeus)	21
(Mustelus)	20, 870
(Salmo)	306
(Squalus)	870
Cantherines	858
Capelin	291
capeuna	554
capillaris	439
capistratus	940
Capitaine	601
capreolus	539, 540, 918
caprinus	929
capriscus	855
caprodes	499, 500
Carangichthys	433
Carangidæ	430, 448, 914
Carangoides	433, 970
Carangops	433, 970
Carangus	433, 437, 970
carangus (Caranx)	438
(Scomber)	438, 970
Caranx	433, 970
Carassius	253
carauno	541
carbonaria (Percina)	500
(Pileoma)	500
carbonarius (Acipenser)	87
(Gadus)	807
(Pollachius)	807
Carcharias	22, 27, 872, 873, 967
carcharias (Carcharodon)	875
(Squalus)	873, 875
Carchariidæ	27, 870
Carcharinus	22, 59, 870, 872
Carcharodon	30, 875
Carelophus	765
Careproctus	740, 957
caribæum (Branchiostoma)	3, 57
caribæus (Diplodus)	930
(Sargus)	930
caribbæa (Belone)	901
caribbæus (Chloroscombrus)	441
(Tylosurus)	901
carinatum (Acanthosoma)	865
carinatus (Placopharynx)	142, 143
(Salmo)	315
carminatus	812
carnatus	674, 675
carolina (Atherina)	405, 908
(Trigla)	735
carolinæ	697, 944
carolinensis (Gobius)	634, 945
(Otolithus)	581
(Seriola)	445, 913
carolinus (Blennius)	760
(Clinostomus)	233
(Gasterosteus)	442
(Pholis)	760
(Prionotus)	735
(Pteraclis)	455
(Trachynotus)	442
Carp	144, 254
carpio (Carpiodes)	118
(Catostomus)	118, 119, 140
(Cyprinodon)	330
(Cyprinus)	254
(Ictiobus)	883
(Moxostoma)	139
Carpiodes	117, 882, 883
Carp Sucker	117, 118, 119
carringtoni	209
caryi	93, 593, 594
cassidii	595
castaneus	10, 897, 868
Cataphracti	640, 724
cataphractus (Agonus)	728, 956
(Cottus)	728
(Gasterosteus)	396
(Gasteracanthus)	396
(Scaphirhynchus)	88
cataractæ (Ceratichthys)	207
(Gobio)	207
(Rhinichthys)	207, 885
(Leucosomus)	223
catenatus	337
Cat-fishes	95, 102, 108, 794
Catonotus	512
Catostomidæ	112
Catostominæ	113
Catostomus	124, 125, 883
catostomus (Cyprinus)	124, 127
(Phenacobius)	206
Catulus	869
catulus (Evorthodus)	632, 944
(Gobius)	632, 633, 944
(Pimelodus)	104
(Scylliorhinus)	869
catus (Amiurus)	104
(Serranus)	920
caudacuta	797
caudafurcatus	109
caudalis	937
caudata (Lamna)	23, 873
caudicula	900, 969
caudimacula (Diplodus)	559, 972
(Hæmulon)	925
(Sargus)	560
Caularchus	748

	Page.
Caulolatilus	625
Caulopus	278
cæurinus (Cyprinus)	225
(Leucosomus)	225
(Mylochilus)	224
(Sebastes)	672
(Sebastodes)	672
cavifrons (Amblyoplites)	467
(Hemitripterus)	686
caxis	548, 921
cayuga	394
Cebedichthyidæ	754
Cebedichthys	773, 962
Centrarchidæ	462, 880
Centrarchus	463
Centridermichthys	693
Centriscidæ	387
Centriscus	388
Centropominæ	527
Centropomus	525, 528
Centroblennius	778
Centronotus	766
Centropristis	533
Centroscyllium	16
Centroscymnus	17
centrura (Dasibatis)	67
(Raia)	48, 67, 879
(Trygon)	67, 879
centrurus (Dasyatis)	47
cepedianum	271
Cephalacanthus	737, 957
Cephalopteridæ	52
Cephaloscyllium	58, 59
cephalus (Semotilus)	221
cerasinus	187
Ceratacanthus	858
Ceratias	847
Ceratichthys	211
Ceratiidæ	847
Ceratocottus	710
Ceratoptera	52
cercostigma	193
cerdale	790
Cernier	532
cernium	532
Cero	426
cervinum	142
cervus	711
Cestracion	26
Cestraciontidæ	62
Cestreus	579
Cetorhinidæ	30, 31
Cetorhinus	31, 875
Chænobryttus	467
Chænopsetta	821
Chætodipterus	613
Chætodon	614, 615, 940
chætodon (Mesogonistius)	471
(Pomotis)	472
Chætodontidæ	614
chalcogrammus	807
chalybæus (Minnilus)	191
chalybeius (Hyphalonedrus)	296, 968
chamæleonticeps	624
Channel Bass	571

	Page.
Channel Cat	107, 108
chantenay	42
Characini	112
Characinidæ	254
Charioteer	542
Charr	316
charybdis	468
Chasmistes	131
Chasmodes	756, 958
Chatoessina	270
Chatoessus	271
Chauliodontidæ	284
Chauliodus	284
Chaunax	846
Cheilichthys	860
chemnitzi	370
Cheonda	230, 241
chesteri	799
Chiasmodon	810, 964
Chiasmodontidæ	964
Chiasmodus	810
chickasavensis	182
chilensis	428
chiliticus	191
Chilomycterus	863, 966
Chilonemus	220
Chimæra	54
Chimæridæ	53
chinensis	390
Chinnook Salmon	306
Chiridæ	640
Chirolophus	765
Chironectes	845
Chiropsis	641
Chirostoma	406
chirurgus	617, 941
Chirus	641
chirus (Xiphister)	772
Chitonotus	691
chlora	169
chloris	441
chloristia	183
chlorocephalus	190, 191
Chloroscombrus	440
chlorosoma	494, 971
chlorostictus	668
chlorurus	537, 918
Chœrojulis	602
Chogset	599
Chologaster	325, 890
Chondrostei	82
Chondrostominæ	145
chouicha	306, 890
Chriodorus	903
Chriomitra	425
Chriope	162
Chromides	608
Chromis	611, 939
chromis (Diabasis)	924
(Hæmulon)	924
(Perca)	924
(Pogonias)	568
Chrosomus	153
chrosomus (Minnilus)	191, 192
chrysitis	157

	Page.
chrysocephalus	186, 187
chrysochloris	266
chrysogaster	208, 209
chrysoleucus	250
chrysomelas	675, 676
Chrysophrys	555, 972
chrysops (Caulolatilus)	626
(Labrax)	530
(Latilus)	626
(Ophichthys)	898
(Ophisurus)	898
(Oxyodontichthys)	898
(Perca)	530
(Roccus)	529
(Sparus)	556, 829
chrysopsis (Hyodon)	260
chrysoptera (Perca)	553, 973
chrysopterum (Hæmulon)	553
chrysopterus (Diabasis)	553, 924, 973
chrysos (Carangus)	438
(Caranx)	435
(Scomber)	438, 970
chrysotus	342
chrysura (Sciæna)	933
chrysurus (Chloroscombrus)	441
(Dipterodon)	933
(Lutjanus)	921
(Mesoprion)	548
(Micropteryx)	441
(Scomber)	441
(Sparus)	548
chrysus (Caranx)	970
Chub	220, 221, 235, 239, 241
Sucker	132, 133
chuss	799
cibarius	8
cibi	436, 912, 970
cicatricosus	837
Cichlidæ	607
Cigar-fish	912
ciliaris (Chætodon)	615
(Holacanthus)	615
(Pomacanthus)	615
(Zeus)	438
Ciliata	796
ciliatus (Blennius)	784
(Epinephelus)	659, 950
(Petromyzon)	8
(Sebastodes)	656, 950
(Zoarces)	784
cimbrius	797
cinerea (Etheostoma)	509
cinereus (Gerres)	935
(Mugil)	935
(Nothonotus)	509
(Squalus)	34, 62
cingulatus (Pomacanthus)	616
(Zygonectes)	342
(Fundulus)	342
cirratus (Squalius)	18
cirratum (Ginglymostoma)	18
cirrhatus (Petromyzon)	5
Cirrhosomus	860
cirrhosum (Lepisoma)	762
cirrhosus (Blepsias)	719
cirrhosus (Trachinus)	720
Cirrostomi	2, 3
Cisco	299, 301
Citharichthys	816, 964
Clam Cracker	47
clarki (Catostomus)	130
(Fario)	313
(Salmo)	315
clathratus	535
clavata	39
claviger	711
Clidoderma	831
Cliola	163, 169
Clinocottus	717
Clinostomus	230, 231
Clinus	761, 962
clodalus	260
Clupea	264, 887
Clupeidæ	262
clupeiformis	299, 301
Clupeinæ	263
clupeoides	300
Clypeocottus	710
Coachman	542
Coal-fish	806
Cobbler-fish	438
Cobia	418
cobitis	163, 170
coccineus	787
coccogenis	188
Cochlognathus	161, 884
Cod-fish	803, 804
Codling	798, 799
Codoma	163, 164, 172
Cœcula	358, 897
cœlolepis	17
cœnosus (Pimelodus)	105
(Pleuronichthys)	829, 830
cœrulea (Cheonda)	242
(Cliola)	182
(Codoma)	183
(Etheostoma)	518
(Meletta)	266
cœrulescens	109
cœruleo-aureus	601
cœruleus (Acanthurus)	617
(Carcharias)	23, 873, 967
(Carcharinus)	873
(Ctenolabrus)	599
(Photogenis)	183
(Pœcilichthys)	517
(Squalius)	241
cognata	698, 953
Coho Salmon	307
colias	424, 910
Coliscus	158
collapsus	138
colliei	54
Colocephali	355
colonus	916
coloratum	390
comatus	381
commersoni	129, 130
communis (Catostomus)	130
(Leucosomus)	220

	Page.
communis (Pogonichthys)	219, 220
complanata	174
compressa (Lota)	802
compressus (Engraulis)	274
(Stolephorus)	274
concinnus (Amblodon)	568
(Gasterosteus)	394
concolor (Ammocœtes)	10
(Chriomitra)	426
(Euschistodus)	611, 939
(Glyphidodon)	611
(Pomacentrus)	611
(Scomberomorus)	425, 973
conductor	443
Coney	541
confertus	159
confinis (Pimelodus)	104
(Salmo)	317
confluentus (Fundulus)	334
(Salmo)	307
conformis	237
Conger	362, 900, 969
conger (Anguilla)	363
(Leptocephalus)	969
(Muræna)	362
Conger Eel	356, 362
congestum	138
Congrogadidæ	790
conocephalus	225
Conodon	550, 923
conorhynchus	258
conspersus	239
constellatus (Chiropsis)	646
(Chirus)	646
(Sebastichthys)	666
(Sebastodes)	665
consuetus	309
conus	141
convexifrons	478
cookianus	461
cooperi (Cheonda)	242
(Leuciscus)	242
(Metoponops)	817
(Raia)	42, 878
(Salmo)	309
(Squalius)	242
copei (Leuciscus)	202
(Squalius)	238
Copelandia	469
copelandi	498
Copper-nosed Bream	479
coralina	877
Coregonus	296, 299, 889, 968
coregonus	139
coretta	429
corinus	62
cornubica	29, 30, 61, 875
cornutus (Chologaster)	325
(Cyprinus)	186, 187
(Hypsilepis)	187
(Leuciscus)	187
(Luxilus)	187
(Minnilus)	186, 187
coroides	576
corporalis	221
Corsair	666
coruscans	278
Corvina	569, 572, 579, 931, 932
Corynolophus	849
Coryphæna	454, 914
Coryphænidæ	454
Coryphænoides	812
Coryphopterus	634, 635
Corythrichthys	906
cosmopolita	440, 441
Cossyphus	601
Cottidæ	682
Cottogaster	497
Cottopsis	693, 694
Cottunculus	687, 952
Cottus	693, 700
couchi (Dionda)	157
(Pœcilia)	348
Couchia	796, 797
couchiana (Limia)	348
(Pœcilia)	348
couesi (Apocope)	210
(Coregonus)	297, 968
(Prosopium)	297
Couesius	218
Cow-fish	854
Cow-nosed Ray	51
Cow-Pilot	611
Crab-eater	418
Craig-flounder	838
Cramp-fish	39
Crappie	464
crassicauda	240
crassilabre	140, 141
crassus (Alvordius)	503
(Squalius)	241
craticula	892
Crawl-a-bottom	130, 506
Creek Fish	133
Cremnobates	764, 962
crenulare	282
Creolus	973
creolus	916
Crevallé	433, 435, 437
criniger	718
crinitus	438, 439
cristagalli (Anoplarchus)	771
(Cebedichthys)	774
Cristivomer	317
Croaker	566, 567, 575, 595
croicensis	938
cromis (Labrus)	568
crossotus	839
Crotalopsis	359
Crucian Carp	253
crumenophthalmus	434, 970
cruoreum (Xiphidium)	773
cruoreus (Squalius)	234
Cryptacanthodes	780
Cryptacanthidæ	754
cryptosus	452
Ctenolabrus	599
cubifrons	850
Cuckold	854
cuculus	733, 956

	Page.
Culius	944
Cultus Cod	646
cumingi	213
Cunner	599
cupreoides	105
cupreus	105
curema	404
curilicus	723
curtus	440
Cusk	802
cuspicauda	858
cutisanserinus	120
Cut-lips	144, 160
cuvieri	395, 911
cyanellus (Apomotis)	473
(Ichthyobus)	114
(Lepomis)	473
cyaneus	188
cyanocephalus	196, 197
cyanoguttatus	608
cyanonoton	267
cyanops	626
cyanostigma (Julis)	603
(Platyglossus)	603, 973
Cybium	425
Cycleptinæ	112
Cycleptus	120
Cyclogobius	637
Cyclopterichthys	745
Cyclopteridæ	744
cyclopus	743
Cyclostomata	3
Cyclopterus	746
cyclotis	212
Cylindrosteus	91
Cymatogaster	588, 590
cymatogramma	497
Cynicoglossus	838
Cynocephalus	22
cynodon	921
cynoglossus	838
Cynoperca	526
Cynoscion	579, 934
cypho (Catostomus)	129
(Esox)	352
Cyphosus	972
Cyprinella	163, 165, 176
cyprinella	114, 883
Cyprinidæ	144
Cyprinodon	328, 894
cyprinoides	887
Cyprinodontidæ	326, 894
Cyprinus	254
cyprinus	119, 120, 883
Cypselurus	380
Cyttidæ	456

D.

	Page.
Dace	186, 221, 230
Daddy Sculpin	702
dactyloptera	679, 950
Dactylopterinæ	732
Dactylopterus	737
Dactyloscopus	753
Dallia	350
dalwigkii	801
Damalichthys	597
damalis	119, 883
Dasibatis	65, 879
Dasyatis	47, 65, 879
Dasybatus	879
davidsoni (Pomadasys)	551
(Pristipoma)	552
(Monacanthus)	857
decagonus	727, 955
decagrammus	641, 645
Decapterus	432
Decaptus	446
declivifrons	939
declivis	912
decoratus	543, 920
decurrens	829
defensor	438
Dekaya	625
dekayi (Gasterosteus)	393
(Isuropsis)	29, 874
(Isurus)	874
(Phycis)	799
(Pimelodus)	105
(Scomber)	424
delicatissimus	274
deliciosa	175
Delolepis	779
delphinus	122
Demoiselle	609
dentata (Pomatopsetta)	826
dentatus (Hippoglossoides)	826
(Paralichthys)	822
(Pleuronectes)	822
(Pseudorhombus)	823
dentex	294
deprandus	353
dermatinus	309
Dermatostethus	385
desmarestia	42
Devil-fish	52
Diabasis	553, 923, 971
Diacope	547
Diamond-flounder	830
diaphana (Hydrargyra)	334
diaphanes (Raia)	41
diaphanus (Calliurus)	473
(Fundulus)	334
Diapterus	583
diceraus	711
diego	424
difformis	120, 883
digrammus	832
dilectus	202
dimidiatum	384, 905
Dinematichthys	795
dinemus	185, 202
Diodon tacheté	863
Diodon	862, 966
Dionda	155
Dioplites	484
diplæmius	197
Diplectrum	534
Diplesion	496
Diplesium	496

	Page.
Diplodus	557, 829, 930, 972
dipterura	48, 71, 879
Discoboli	738, 745
discobolus	125, 883
dispar	341
dissimilis (Ceratichthys)	183, 215, 216
(Couesius)	218
(Leuciscus)	216
(Leucosomus)	218, 219
Ditrema	594, 936
Doctor-fish	617
dodecaëdrus	723
Dog-fish	15, 16, 94, 350
Dog-salmon	305, 306
Dog Shark	19
dolichogaster	768
Doliodon	441
Dollardee	479
Dollar-fish	451
Dolly Varden Trout	319
dolomiei	916
dolomieu (Micropterus)	485
Dolphin	454
dombeyi	57, 867
dominus	203, 204
Doncella	601, 602, 603
Dormitator	631, 944
dormitator	631, 972
dormitor	972
Dorosoma	271, 889
Dorosomatidæ	270
Dory	456, 525
dorsalis	220, 221, 912, 913
dorsatus	867, 868
dorsomacula	560
dovii	930
Drum	567, 568
drummond-hayi	540
drummondi (Otolithus)	934
dubium (Campostoma)	150
(Exoglossum)	149
dubius (Ammodytes)	415
(Fierasfer)	791
Duck-bill Cat	83
ductor	443
dugesi	106
dulcis	885
Dules	542, 920
dumerili (Squalus)	35
duodecim	888
duquesni	140
Dussumieriinæ	263
dux	601

E.

	Page.
Eagle Ray	49, 50
earlli	798
Echeneididæ	416
Echeneis	416
Echinorhinus	14, 869
Echiostoma	286
edentula	84
Eels	354
Eel-pout	783, 784
effulgens	493
eglanteria	40, 41
egregia (Tigoma)	236
(Gila)	239
egregius (Squalius)	236
Elacate	418
Elacatidæ	418
Elagatis	446
Elasmobranchii	12, 57
elassodon	826
Elassoma	461, 915
Elassomatidæ	461, 880, 915
Electric Rays	38
elegans (Blakea)	763
(Boleichthys)	519
(Cyprinodon)	329
(Gibbonsia)	763
(Diabasis)	923
(Gila)	227
(Hæmulon)	924
(Leuciscus)	228
(Myxodes)	763
(Nanostoma)	510
Eleotridinæ	630
Eleotris	631, 944
eleutherus	99
elliotti	53
ellipticus	271
elongata (Clupea)	265
(Gila)	232
(Umbrina)	578, 932
elongatus (Benthodesmus)	910
(Catostomus)	120, 121
(Clinostomus)	232
(Cycleptus)	121
(Lepidopus)	910
(Lepomis)	475
(Leuciscus)	232
(Luxilus)	232
(Ophiodon)	646
(Osmerus)	295
(Pleuronectes)	838
(Pomotis)	475
(Sclerognathus)	121
(Sebastes)	669
(Sebastodes)	669
(Squalius)	232
Elopidæ	260
Elops	261, 968
emarginatus	549
Embiotoca	594
Embiotocidæ	585
Emerald-fish	635
emiliæ	247
emorii	229, 230
encæomus	945, 973
Enchelycephali	354
Enchelyopus	796
enchrysurus	940
Engraulididæ	271
Engraulis	272
Enneacanthus	469
Enneacentrus	541
Ennichthys	590
Enophrys	710
ensis	797

	Page.
entomelas	659, 660
Entosphenus	7, 57, 867
eos (Boleichthys)	521
(Chrosomus)	154
(Othonops)	639
(Pœcilichthys)	520
Ephippidæ	612
Ephippus	613
Epicopus	809
Epigonichthys	2, 57
epihexodon	8, 57
Epinephelus	539, 918, 919, 920
episcopus	157
Episema	193
Eques	932
equestris	110, 882
equisetis	454, 914
erebennus	105
eriarchus	469, 470
Ericosma	503
Ericymba	204
Erimyzon	132
erinacea	40
erochrous	520
Erogala	163, 165, 179
Erythrininæ	254
erythrogaster (Chrosomus)	153, 154
(Leuciscus)	154
(Luxilus)	153, 154
(Serranus)	540
erythrurus	140
eschrichti	848
esculentus	438
esmarki	786
Esmeralda	635
Esocidæ	351
Esox	352
estor (Esox)	353, 354
(Gila)	233
(Squalius)	232
Estrella	491
Etheostoma	500, 512
Etheostomatinæ	486, 488
Etropus	839
Etrumeus	263
Eucalia	394
Euchalarodus	831, 837
Eucinostomus	583
Euctenogobius	633, 945
Eucyclogobius	637
Eugomphodus	27
Eulachon	291, 292
Eulamia	22, 59, 60, 872, 967
Euleptorhamphus	377, 903
Eumesogrammus	774
Eumicrotremus	746, 957
Eupomotis	472, 482
euryopa (Cliola)	171
euryops (Myxostoma)	140
euryopus (Hudsonius)	171
euryorus	481
eurystoma	180
Eurystomus	880
Euschistodus	611
Euthynnus	429
Eutychelithus	568
evansi	156
Eventognathi	111, 882
evides (Alvordius)	503
(Clinus)	763, 962
(Ericosma)	504
evolans (Exocœtus)	378
(Halocypselus)	377
(Prionotus)	735
(Trigla)	736
Evorthodus	632, 945
exasperatus	63, 64, 876
exilicauda	152, 153
exiliens	380, 904
exilis (Boleichthys)	521
(Belone)	374
(Hippoglossoides)	827
(Noturus)	100
(Pœcilichthys)	521
(Tylosurus)	374
eximius	329, 890
Exocœtus	378, 903, 904
Exoglosum	160

F.

	Page.
faber	613
fabricii (Campylodon)	370
(Centroscyllium)	16
(Cottus)	709
(Gadus)	807
(Gunnellus)	778
(Liparis)	742
(Lumpenus)	778
(Macrurus)	811
(Spinax)	16
falcata (Seriola)	445, 913
falcatus (Carangops)	437
(Caranx)	436, 912
(Labrus)	601
(Lachnolæmus)	601
(Trisotropis)	538
fallax (Caranx)	437, 912, 970
(Pomotis)	478
(Trachurus)	911
Fall-fish	222
Fall Herring	266
Salmon	306
Fario	312
fasciata (Seriola)	445
fasciatum (Pristipoma)	551
fasciatus (Achirus)	841
(Alvordius)	504
(Bryttus)	470
(Catonotus)	513
(Catostomus)	136
(Centronotus)	767
(Esox)	352
(Diplesion)	505
(Grystes)	485
(Gunnellus)	767
(Larimus)	578
(Murænoides)	767
(Pimephales)	158
(Pogonias)	568, 569
(Pomadasys)	551, 923

	Page.
fasciatus (Scomber)	446
(Sebastes)	652, 676
(Sebastodes)	652
(Syngnathus)	383
(Zonichthys)	446
fascicularis	534, 535, 971
fasciolaris	676
Fat-back	269
Fat-head	158, 602
Father-lasher	701
favosus	961
fecundus	129
felinus	105
felis (Anarrhichthys)	783
(Arius)	110, 882
(Mustelus)	20
(Silurus)	110
fenestralis	973
ferox (Alepidosaurus)	276
(Atractosteus)	92
(Lepisosteus)	92
(Squalus)	874
(Stomias)	286
ferrugineus	834
feuille (Polyodon)	83, 84
Fierasfer	791
Fierasferidæ	791
filamentosus (Hemirhamphus)	903
(Megalops)	261
(Phycis)	799
File-fish	856, 858
fimbria	650
fimbriatus	784
Fishing-frog	844
Fistularia	389
Fistulariidæ	388, 390
flabellare	513
flabellatus	513
flagellum (Raia)	50
(Saccopharynx)	365
flammeus	243
Flannel-mouth Cat	108
Flasher	555
flavescens (Bodianus)	524
(Gadus)	803
(Perca)	524
flavicauda	541
flavidus (Apodichthys)	769
(Aulorhynchus)	391
(Sebastodes)	657
flavipinnis	156, 884
flavolineatus	561
flavulus	332
flavus (Noturus)	100
Flesus	831
Fliaum	662
floridæ (Jordanella)	328
(Siphostoma)	905, 906
floridana (Cichla)	485
floridensis (Bryttus)	468
(Calliurus)	468
(Fundulus)	236, 891
floripinnis	339
Flounder	813, 822, 835
Flute-mouth	390
fluviatilis (Algoma)	157
(Ammocœtes)	11
(Hudsonius)	171
(Hybognathus)	157
(Lampetra)	11
(Perca)	524
(Petromyzon)	7
Flying fish	371, 378
Fly-fish	667
Flying Gurnard	737
Robin	738
fœtens	280
folium	83, 84
fontinalis	320, 890
Fool-fish	856
forbesi	174
formosa (Algansea)	245
(Cliola)	175
(Limia)	347
(Mollienesia)	347
(Moniana)	175, 185
(Perca)	553, 971
(Uranidea)	955
formosulum (Campostoma)	150
formosum (Hæmulon)	553
formosus (Alburnus)	185
(Calliurus)	473
(Cottus)	699, 955
(Diabasis)	553
(Girardinus)	349
(Leuciscus)	245
(Leucus)	245
(Serranus)	971
forsterianus	127
Four-eyed fish	940
Fox-shark	27
francisci	32, 33, 875
franklini (Cottus)	699
(Pleuronectes)	837
(Uranidea)	699, 953, 954
fraterculus	225
fremebundus	554, 925
freminvillei	51
frenatus	589
Fresh-water Drum	567
fretensis	167
Friar	405
Frigate Mackerel	424, 425
frigida	174
Frog-fish	845
frontalis	187
Frost-fish	806
fucorum (Apodichthys)	770
(Blennius)	759
fulgida	252
fuliginosus (Balistes)	855
(Chilomycterus)	864
(Diodon)	865
fulvomaculatus	551, 923
funduloides	233
Fundulus	331, 891, 892, 894
furcatum (Ditrema)	596
furcatus (Amiurus)	109
Furcaria	611, 939
furcatus (Amiurus)	109

	Page.
furcatus (Anthias)	534
(Cypselurus)	380
(Exocœtus)	381
(Ictalurus)	109, 882
(Phanerodon)	596
(Pimelodus)	109
furcifer (Anthias)	916
(Brachyrhinus)	916
(Creolus)	973
(Pimelodus)	109
(Serranus)	916
furciger	952
fürthi	923
fuscum (Siphonostoma)	383, 906
(Siphostoma)	383
fuscus (Bythites)	795
(Hemirhombus)	817
(Syngnathus)	383
fusiformis (Phalangistes)	726
(Boleichthys)	520
(Boleosoma)	520
(Hololepis)	520
(Pœcilichthys)	520

G.

Gadidæ	794
Gadus	803
Gaff-top-sail	111
Gaff-top-sail Pompano	912
Gaidropsarus	796
gairdneri	313, 314
galactura	179, 180
galeatus	709
Galeocerdo	21
Galeorhinidæ	18, 870
Galeorhinus	21, 870
Galeus	21
galeus (Galeorhinus)	21, 60, 871
(Squalus)	21
Gallichthys	438
Gallus	438
Gambusia	344, 893, 894
gardeniana (Hiatula)	936
gardenii (Sternoptyx)	451
(Stromateus)	451
gardoneus	249
Gar-fishes	371
Garibaldi	610
Gar-pike	91
Gar Pikes	87
Garrupa	539, 662, 672, 676
Gaspereau	267
Gasterosteidæ	392
Gasterosteus	392, 393
Gastrophysus	859
gavialis	90
gayi	809
gelatinosus	740, 957
gelida (Ammocrypta)	489
gelidus (Ceratichthys)	216
(Gobio)	217
geminatus	759
generosus	123
gentilis	757, 758, 959, 960
Genyonemus	574, 932
Genyoroge	547
Genypterus	963
geometricus	863, 864
georgii	909
germo	429
Germon	428
Gerres	583, 934, 935
Gerridæ	582
Ghost-fish	780
gibba (Liparis)	741
gibber (Salmo)	305
Gibbonsia	763
gibbosa (Cliola)	174
(Gila)	239
(Lavinia)	240
(Moniana)	174
(Perca)	483
(Tigoma)	239
gibbosus (Aphredoderus)	460, 461
(Catostomus)	134
(Cyprinodon)	329, 890
(Lepomis)	482
(Leuciscus)	240
(Pomotis)	480
(Squalius)	239
gibbsi (Hemilepidotus)	715
(Salmo)	315
gibbus (Hypsilepis)	187
(Liparis)	741
(Minnilus)	187
gigas (Ephippus)	613
(Seriola)	913
(Stereolepis)	561
Gila	227
gilberti	959
gilli (Lepomis)	468
(Xystroplites)	482
Gillichthys	636
Ginglymodi	89
Ginglymostoma	18, 58
Ginglymostomatidæ	17, 57
girardi	436
Girardinichthys	342
Girardinus	348
Girella	560
Girellinæ	546
Gizzard Shad	270, 271
glaber (Cyclopterichthys)	745
(Platessa)	837
(Pleuronectes)	837
glabra (Liopsetta)	837
glaciale (Myctophum)	283
glacialis (Cottus)	955
(Gadus)	807
(Pleuronectes)	837
(Scopelus)	283
gladifer	421
gladius (Histiophorus)	421
(Scomber)	421
(Tylosurus)	901
(Xiphias)	420
Glaniostomi	84

	Page.
Glass-eye	525
glauca (Lamna)	29
(Oxyrhina)	29, 874
glaucofrænum	635
glaucus (Carcharias)	872, 967
(Carcharinus)	22, 60
(Chætodon)	441, 970
(Isuropsis)	874
(Isurus)	28, 874
(Squalus)	22
(Trachynotus)	443, 912, 970
globiceps (Coryphæna)	455
(Oligocottus)	718
gloriosus	470
Glossamia	564
Glut Herring	267
glutinosa	4, 5
Glyphidodon	610
Glyptocephalus	838
Gnathanodon	433
Goat-fish	565
Goat's-head Porgee	929
Gobiesocidæ	747
Gobiesox	748, 957
Gobiidæ	629
gobioides (Cottus)	699
(Hypsicometes)	808
(Uranidea)	699
Gobiomoroides	631, 972
Gobiomorus	631, 972
Gobionellus	635, 947
gobioninum	149
Gobiosoma	638, 948
Gobius	633, 944, 945, 946
Goby	629, 633
Goggle-eye	466, 467
Goggler	434
Gold-fish	253
Golet	319
gomesi	898
Goniodus	14
Gonioperca	535
Goodea	348
goodei (Erimyzon)	134
(Lucania)	343
(Ptilichthys)	369
Goody	574
Goose-fish	844
Gorbuscha	305
gorbuscha	305
goreensis	442, 912
Goujon	102
Gourd-seed Sucker	121
gracile (Boleosoma)	522
gracilis (Blennius)	779
(Cottus)	699
(Cyprinus)	220
(Gadus)	804
(Gila)	229
(Gobius)	637
(Gambusia)	345, 346, 894
(Hybopsis)	213, 214
(Lepidogobius)	637
(Leptoblennius)	779
(Leptogunnellus)	778
gracilis (Leuciscus)	187, 220
(Lycodes)	787
(Moniana)	175
(Perca)	524
(Pimelodus)	109
(Platygobio)	219
(Pœcilichthys)	521
(Ptychocheilus)	226
(Squalius)	237
(Tigoma)	237
(Tilesia)	805
(Uranidea)	699
(Xiphophorus)	346
graciosus	109
graëllsi	963
grahami (Gila)	228
(Leuciscus)	229
(Oligocephalus)	517
Grammatopleurus	641
Grammiconotus	374
Grande Écaille	887
grandipinnis	185
grandis (Fundulus)	336, 891
(Gila)	226
(Leuciscus)	226
(Ptychochilus)	226
grandisquamis	603, 936, 937
granulata	42
Graodus	163
Grass Bass	465
Gray Snapper	548
Trout	581
grayi	119
Grayling	302
Gray Pike	526
Green Bass	484
Cod	806
Green-fish	448
Greenland Halibut	819
Green Pike	353
Sturgeon	86
Grenadier	810, 811
grex (Scomber)	424
Grindle	94
grisea (Dionda)	155
(Lucioperca)	526
(Sciæna)	568
griseolineatum	384, 905, 906
griseum (Stizostedium)	526
(Carcharias)	28
griseus (Catostomus)	127
(Mesoprion)	549
(Squalus)	62
grœnlandicus (Cottus)	702, 703, 955
(Gunnellus)	767
(Himantolophus)	849
(Hippoglossus)	820
(Microstoma)	290
Gronias	102
gronovii	449
Grouper	539
Grubby	701
grunniens	567
Grunt	553
Grystes	484

	Page.
Grystina	463
guacamaia	607, 938
guaguancho	411
Guasa	542, 920
guasa	542, 920
guativere	541
gula (Diapterus)	935
(Gerres)	934
(Gila)	236
(Squalius)	236
gulonellus	220
gulosa (Uranidea)	695
gulosus (Centrarchus)	468
(Centridermichthys)	695
(Chænobryttus)	468, 915
(Cottopsis)	695
(Gobius)	634, 945
(Lepidogobius)	945
(Pomotis)	467, 468
gunelliformis	767, 769
Gunnellops	766
Gunnellus	766
gunnellus (Blennius)	767
gunneri	31
gunnisoni	176
Gurnards	731, 733
guttata (Coryphæna)	914
(Perca)	537, 920
(Scorpæna)	679
guttatus (Astroscopus)	629
(Bodianus)	541
(Chiropsis)	645
(Chirus)	645
(Enneacanthus)	471
(Epinephelus)	919, 973
(Lampris)	453
(Percopsis)	322
(Pomotis)	470
(Sebastapistes)	680
(Zeus)	453
(Zygonectes)	341
guttulata (Hypsopsetta)	830
guttulatus (Hippocampus)	907
guzmaniensis	126, 883
Gymnacanthus	708
Gymnelis	789
Gymnodontes	859
Gymnothorax	356, 969
gymnura (Trygon)	66
gymnurus (Gasterosteus)	395
gyrinus (Electris)	631
(Noturus)	98
Gyropleurodus	32, 875

H.

	Page.
Haddo	305
Haddock	803
Hadropterus	505
hæmatura	166
Hæmulon	553
Hæmulum	554
Hair-tail	421, 422
Hake	808
Halælurus	58
Halatractus	444
Halecomorphi	92
Half-beak	376
Halias	795, 963
Halibut	818, 819, 821
Halichœres	602
Halieutæa	851
Halieutichthys	851
Haliperca	535, 917
halleri (Urolophus)	46
Halocypselus	377
Haloporphyrus	800
hamatus (Icelus)	691, 952
Hamlet	918
Hammer-head	130
Hammer-headed Shark	25, 26
hammondi (Percopsis)	323
(Pimelodus)	109
Hand-saw Fish	276
Haplochilus	338
Haploidonotus	567
Haplomi	323
Hard-head	313
Hard-mouth	150
Hard-tail	912
Hare-lip Sucker	143, 144
Harengula	268
harengulus	584, 935
harengus (Coregonus)	301
(Clupea)	265
(Lavinia)	153
(Salmo)	301
harfordi (Ptychochilus)	226
Harpe	601, 936
Harvest-fish	450, 451
hastata (Dasibatis)	48, 70
(Pastinaca)	48
(Trygon)	70, 879
hastatus (Gobionellus)	636
Hayko	305
Head-fish	864, 865
hearnii	320
heermanni	592
Heliastes	611
Helioperca	472
helleri	346
Helmichthyidæ	362
Helops	85
helvomaculatus	667
Hemdurgan	651
Hemibranchii	387
Hemilepidotus	714
hemilepidotus	715
Hemioplites	469
Hemirhamphus	376, 902
Hemirhombus	816, 964
Hemistoma	606
Hemitremia	162
Hemitripterinæ	683
Hemitripterus	685
Hemitrygon	47
henlei	20, 21, 59, 60, 870
henshalli	338
henshavii (Apocope)	210
henshawi (Salmo)	316

	Page.
hentzi	758, 960
heptagonus	386, 906
Heptanchus	34
Heptatrema	867, 967
Heptranchias	34, 61, 62
Herichthys	608
Heros	608, 939
heros	480, 481
Herpetoichthys	359, 898
Herring	264, 265
herschelii	909
Heterandria	344, 345
heteroclitus	336
heterodon	163
Heterodontidæ	32, 967
Heterodontus	32, 875
Heterognathus	406
Heterolepidina	640
Heteropygii	324
Heteroprosopon	828
Heterosomata	813
Heterostichus	763, 962
heterurum	271
hexacanthus	465
hexacornis (Cottus)	705
Hexagrammus	641, 949
hexagrammus	644
Hexanchidæ	34
Hexanchus	61, 62
hians	373, 901
Hiatula	936
hiatula	936
Hickory Shad	266, 271
hieroglyphicus	341
hillianus	903
Himantolophus	849
Hind	540
hinnulus	19, 20, 59, 870
Hiodon	259
Hippocampidæ	385
Hippocampus	386, 906, 907
hippocampus	386
Hippocephalus	723
Hippoglossina	821
Hippoglossoides	825, 826
hippoglossoides	819, 820
Hippoglossus	818
hippoglossus	819
hippops	149
hippos	435, 437, 438, 970
hippurus	454, 914
hippus	437
hirudo	10, 868
hirundo	712, 955
hispidus	966
Histiocottus	719
Histiophorinæ	419
Histiophorus	421
histrio	845, 846, 965
hiulcus	273, 888
Hoe	16
Hog-fish	499, 501, 601
Hog Molly	130, 499
Hog Sucker	130
Holacanthus	615
holbölli	847
holbrooki (Diplodus)	559, 930, 972
(Echeneis)	417
(Eupomotis)	482
(Gambusia)	345, 893
(Heterandria)	345, 894
(Lepomis)	482, 916
(Ophidium)	793, 963
(Pomotis)	482
(Sargus)	559, 560
Holconotus	590, 592, 936
Holia	305
Holocentrum	459, 915
Holocentrus	459, 915
Holocephali	53
Hololepis	514
Holostei	88
Homalopomus	809
homonymus	584, 935
Homoprion	570
hoodi	320, 321, 890
Hoopid	307
Hopladelus	102
Hoplostethus	458
Horned Dace	221
Horned Pout	104
Horn-fish	526
Horny-head	211
Horse Crevallé	437
Horse-fish	440
Horse-head	439
Horse Mackerel	429, 432, 911
houghi	109
Hound Sharks	19
hoyi (Argyrosomus)	300
(Coregonus)	299
(Uranidea)	700
hubbardi	832
hudsonia (Cliola)	171
hudsonicus (Salmo)	320
Hudsonius	163, 164
hudsonius (Catostomus)	127
(Hippocampus)	386, 907
humboldti (Scopelus)	284
(Squalius)	234
(Tigoma)	234
humeralis (Chœrojulis)	603
(Julis)	603
(Leiostomus)	574
(Oligocephalus)	513
(Platyglossus)	603, 936, 937
humilis (Bryttus)	479
(Cottus)	705
(Gambusia)	345, 894
(Lepomis)	479
Humpback Salmon	305
Huro	484
huronensis	91
Huso	85
hyalinus	214
Hybognathus	155, 884, 968
Hybopsis	163, 164, 165, 211, 213
Hyborhynchus	159
Hydrargyra	331, 332
Hydrolagus	54

	Page.
Hydrophlox	185
hydrophlox	233
Hylomyzon	124, 130
Hynnis	438
Hyodon	259
Hyodontidæ	259
Hyostoma	496
Hypeneus	565
Hypentelium	130
Hyperistius	465
Hyperoartia	6
Hyperotreta	4
Hyperprosopon	590, 591
Hyphalonedrus	296, 968
Hypleurochilus	758
Hypocritichthys	590, 591
Hypohomus	505
Hypomesus	294
Hypoplectrus	537, 917
Hypoprion	59, 61
Hypoprionodon	61
Hyporthodus	541
Hypsagonus	722
hypseloptera	184, 185
Hypsilepis	185
Hypsicometes	808
hypsinotus	215
Hypsiptera	798
Hypsopsetta	830
Hypsurus	593
Hypsypops	610
Hysterocarpinæ	586
Hysterocarpus	586
hystrix	863

I.

Icelus	689
Ichthælurus	107
Ichthelis	472
Ichthyobus	114
Ichthyomyzon	9, 867
Icichthys	621
Icosteidæ	619
Icosteus	620
Ictalurus	106, 881
ictheloides	466
Ictiobus	113, 882
illecebrosus	193
immaculata (Coryphæna)	914
immaculatum (Cybium)	427
immaculatus (Salmo)	320
Imostoma	498
imperator	909
imperialis (Esox)	372
(Mupus)	914
(Sebastes)	679
(Tylosurus)	372
impetiginosus	540, 973
inæquilobus	223
incisor	480
Inconnu	304
inconstans	394
incrassatus	221
indicus (Heptancus)	34
(Histiophorus)	421
indicus (Notidanus)	34, 63
(Tetrapturus)	909
inermis (Anoplagonus)	725
(Aspidophoroides)	725
(Raia)	44
(Sebastodes)	672
ingens (Gunellus)	767
(Hippocampus)	386
innominatus	343
inopinatus	395
inornata (Lota)	802
(Raia)	878
inornatus (Apodichthys)	770
(Cryptacanthodes)	781
inscriptum (Nanostoma)	512
inscriptus (Nothonotus)	512
(Pomotis)	478
(Xenotis)	478
insculptus	396
insigne (Pimelodus)	100
insignis (Catostomus)	130
(Noturus)	100
insolatus	612
insulæ-sanctæ-crucis	938
integripinnis	764
intermedia (Tigoma)	238
intermedius (Gasterosteus)	396
(Pomoxys)	465
(Saurus)	889
(Squalius)	238
(Synodus)	889
interrupta (Morone)	530
interruptus (Ambloplites)	466
(Archoplites)	466
(Centrarchus)	465, 466
(Genytremus)	923
(Pomadasys)	923
(Roccus)	530
inurus	892
Ioa	490, 971
Ioglossus	948
ionthas	960
ios	948
irideus (Centrarchus)	464
(Labrus)	464
(Salmo)	312
iris (Cliola)	172
(Hypsilepis)	172
(Leuciscus)	221
Irish Pompano	934
Isabelita	615
ischanus	250
ischyrus (Lepomis)	474
(Parophrys)	833
(Pleuronectes)	832
Isesthes	757, 959, 960
islandicus	779
isodon	24, 874
Isogomphodon	23
isolepis (Aphredoderus)	461
(Lepidopsetta)	832
(Parophrys)	832
(Pleuronectes)	832
(Sternotremia)	461
Isopisthinæ	566

Page.

Isopsetta 832
Isospondyli 256
Istiophorus 421
Isuropsis 28
Isurus 28, 29, 874

J.

Jack 656
Jack Salmon 525
jacksoni 595
jacobi 571
jacobœa 417
jaculus 202
jaok 705
japonensis 309
japonicus 723
jarrovii (Lepidomeda) 252
(Minomus) 123
jejunus 194
jemezanus 203
jeniguano 925
Jerker 212
jessiæ 518
Jew-fish 262, 531, 540
John A. Grindle 94
Johnius 569
Johnny 718
Johnny Darter 492
Johnny Verde 536
John Paw 540
jonesi 347
Jordanella 327
jordani (Hemilepidotus) 715
(Hippoglossoides) 827
josephi 793, 963
jugalis 172
Jugulares 783
Julidinæ 598
Jumping Mullet 142
Jump-rocks 142
June Sucker 132
Jurel 912

K.

kaupi 364
kayko 306
Kelp-fish 603, 763, 764
kentuckiensis 179, 180
kennerlyi 309
kennicotti (Catonotus) 514
(Coregonus) 298
keta 305, 307
Killifishes 331, 332, 336
King-fish 453, 576, 577, 582
King-of-the-Herring 617, 618
King-of-the-Mullets 563
King-of-the-Salmon 618
King Salmon 306
kisutch 307, 308
Krasnaya Ryba 308
kumlieni 699, 953
Kyphosus 972
kysutsch 308

Page.

L.

labiatus 127
Labidesthes 406, 908
Labracinæ 527
labradoricus (Acanthocottus) 704
(Coregonus) 299
(Cottus) 704
Labrax 528, 641
Labridæ 597
Labrinæ 598
Labrosomus 762, 962
labrosus (Ceratichthys) 217
(Zoarces) 784
lacera 143, 144
lacertosus 192
Lachnolæmus 600
lacrymalis 140
laciniata 908, 969
Lactophrys 853
lacustris 108, 882
Lady-fish 258, 601
Læmargus 14
lætabilis 175
lætus 768
lævicaudatus 386
lævigatus (Agonus) 723
(Antennarius) 846
(Chironectes) 846
(Lagocephalus) 860
(Tetrodon) 860
lævis (Acipenser) 87
(Mustelus) 60, 870
(Pleuracromylon) 60
(Raia) 42
(Rhinotriacis) 60, 870
La Fayette 451, 574
Lagocephalus 859
lagocephalus (Chirus) 641
(Grammatopleurus) 641
(Labrax) 641
(Oncorhynchus) 306
(Salmo) 306
Lagochila 143
Lagodon 558, 929, 971
Lake Herring 301
Lake Sturgeon 87
Lake Trout 314
lalandi 444, 912, 913
lamia 23, 60, 873
lamiella 873
Lamna 29
Lamnidæ 28
lamotteni 868
Lamper-eel 11
Lampern 7
Lampetra 7, 8, 57, 867
lampetræformis 779
Lamprey 6, 867
Lampridida 453
Lampris 453
Lampugus 454
Lancelet 2, 3, 867
lanceolata (Sciæna) 570, 931
lanceolatum (Branchiostoma) 57, 867

	Page.
lanceolatus (Eques)	932
(Gobius)	636
(Homoprion)	570
(Limax)	3, 867
(Stelliferus)	570
Lancet-fish	274, 276
Lant	414
Large-mouthed Black Bass	484
Large-scaled Sucker	140
Larimus	578, 933
lata	67
laterale (Ditrema)	594
lateralis (Abramis)	251
(Alvarius)	522
(Artedius)	690
(Calycilepidotus)	690
(Embiotoca)	595
(Icelus)	689
(Mylocheilus)	225
(Pœcilichthys)	522
(Richardsonius)	251
(Scorpænichthys)	690
(Tæniotoca)	595
(Zygonectes)	341
laticaudus (Scoliodon)	24
laticeps (Aetobatis)	879
(Cephaloscyllium)	59
(Scyllium)	58, 59
(Stoasodon)	879
latifasciatus	329
latifrons	782
Latilidæ	623, 880
latimanus	373, 901
latior	299
latipinna (Mollienesia)	347
latipinnis (Catostomus)	125
(Zaniolepis)	647
latirostris	879
laurettæ	889
lauta	453
Lavinia	152
Lawyer	94, 802
Least Darter	523
Leather-jacket	446, 447, 855
Leather-sided Minnow	234
Lebias	328, 329
Leisomus	860
Leiocottus	711
Leiostomus	574
leiurus	395
Le-Kai	305
Lembus	630
Lemniscati	362
lemniscatus	100
lentiginosus	65
leonensis	517
leonina	174
Lepibema	529
lepida (Boleosoma)	517
(Cliola)	177
Lepidion	800
Lepidogobius	637, 945, 947
Lepidoleprus	811
Lepidomeda	251
Lepidopsetta	831, 833
Lepidorhombus	815
Lepidosteidæ	89
Lepidosteus	90, 880
lepidum (Boleosoma)	517
lepidus (Gobius)	637
(Oligocephalus)	517
(Pœcilichthys)	517
Lepiopomus	476
Lepisoma	762
Lepomis	472, 484
leptacanthus (Noturus)	98
Leptagonus	726, 955
Leptoblennius	778
Leptocardii	2
Leptocephalidæ	362
Leptocephalus	362, 969
leptocephalus	215
Leptoclinus	776
Leptocottus	713
Leptogunnellus	776
Leptophidium	793
Leptops	881
Leptorhynchus	366
leptorhynchum	384, 906
Leptoscopidæ	752
leptosomus	249
Lepturus	422
lepturus (Anarrhichas)	782
(Trichiurus)	422
lessonii (Tetrapturus)	909
lesueurianum (Exoglossum)	160
Letharchus	896
leuchtenbergi	366
leuciodus	194, 195
Leuciscinæ	146
leuciscus	230
leucops (Photogenis)	201
leucopus (Photogenis)	180
leucorhynchus	38, 876
Leucos	244, 887
Leucosomus	220, 222
leucostictus	610
Leucus	244, 887
Leuresthes	405
Leurynnis	784
lewisi	315
libertatis	269
Limanda	831, 834
limandoides	826
limbatus	23, 24, 61
limi	350
Limia	346, 347
Limnurgus	342
limosa (Myxine)	5
limosus (Pilodictis)	101
(Pimelodus)	102
lineata (Alosa)	267
(Coryphæna)	973
(Echeneis)	417, 970
(Embiotoca)	595
(Liparis)	742, 957
(Novacula)	605
(Sciæna)	529, 575
(Tigoma)	237
(Trigla)	736

	Page.
lineatus (Achirus)	841
(Amblodon)	568
(Cyclopterus)	742
(Dormitator)	632, 944
(Genyonemus)	574
(Grystes)	646
(Labrax)	529
(Liostomus)	575
(Micropogon)	575
(Mugil)	403, 404
(Phthirichthys)	969
(Pleuronectes)	842
(Prionotus)	736
(Roccus)	529
(Squalius)	236
(Trichodon)	627
(Xyrichthys)	605, 973
(Zygonectes)	339
lineolata (Cliola)	168
(Mollienesia)	894
(Pelamys)	428
(Pœcilia)	347
lineolatum (Etheostoma)	513
lineolatus (Alburnus)	168
(Catonotus)	513
(Leuciscus)	168
(Zygonectes)	341
Ling	646, 802, 909
linsleyi	514
Liocottus	711, 955
liolepis	825
Liomonacanthus	858
Lioniscus	85
liopeltis	87
Liopsetta	831
liorus	131, 132
liosternus	206
Liostomus	573
Liparididæ	738
liparina	739
Liparis	740
liparis	742
Lipomyzon	132
Lirus	452, 914
lirus (Lepomis)	483
(Minnilus)	199
(Nototropis)	200
Litholepis	92, 880
littoralis (Eugomphodus)	28
(Menticirrus)	577, 933
(Odontaspis)	874
(Squalus)	28
(Umbrina)	577
liturosus	966
lividus (Petromyzon)	8
(Silurus)	105
Liza	403
Lizard-fish	279, 280
Lobotes	554
Lobotinæ	546
lockingtoni	621
Log Perch	499
lonchurus	943
longa (Dasibatis)	66
Longe	317
Long-eared Sun-fish	477
longiceps (Hybopsis)	168
(Siboma)	241, 887
longicollis	900
longimanus	482
longipinne (Holocentrum)	459
longipinnis (Rhombus)	451
longirostris (Alburnops)	167
(Catostomus)	126
(Cliola)	167
(Esox)	374
(Euleptorhamphus)	377
(Hemirhamphus)	377
(Tylosurus)	374, 902
longirostrum (Catostomus)	124
longispinis	480
Long-nosed Dace	207
Gar	91
Sucker	127
longulus	473
longus	899
Look-down	439
Lophiidæ	844
Lophius	844
lophius	107
Lophobranchii	381
Lopholatilus	624
Lophopsetta	815
lordii	320
loricatus	723
Lota	801
lota (Gadus)	802
louisianæ	383, 384, 904, 906
lubricum	3
Lucania	342
lucens	213
luciæ	342
lucidus (Coregonus)	301
(Luxilus)	249
(Notemigonus)	249
(Salmo)	301
lucioceps	281
Lucioperca	525
Luciotrutta	304
lucius (Esox)	353
(Ptychochilus)	227
ludibunda	177
lugubris	177
lumbricus	899
Lumpenus	776
lumpenus	778
Lump-sucker	744
Lumpus	746
lumpus	747
luna (Lampris)	453
(Pomotis)	480
(Zeus)	453
lunatus	885
lunulatus	920
lupus (Amiurus)	107
(Anarrhichas)	781
(Ictalurus)	107
(Pimelodus)	107
luteus	885
lutipinnis	190

	Page.
Lutjaninæ	546
Lutjanus	547, 921, 971
lutrensis	173, 175
luxatus	132
luxiloides	177
Luxilus	185, 186, 250
lycaodon	308, 309
Lycodidæ	783
Lycodalepis	788
Lycodes	785
Lycodopsis	784
lyricus	633, 945
lynx	107
lythrochloris	478
Lythrurus	185, 196

M.

macarellus	433
Macho	403
mackenzii	304
Mackerel Scad	432
Mackinaw Trout	317
maclura	46, 47
macrocephalum (Etheostoma)	501
macrocephalus (Alvordius)	501
(Gadus)	804
(Gunnellus)	767
(Semotilus)	221
macrochilus	128
macrochirus	475
Macrodonophis	359, 897
macrolepidota (Myxostoma)	140
macrolepidotum (Moxostoma)	140
macrolepidotus (Catostomus)	140
(Leuciscus)	223
(Pogonichthys)	223
macrophthalmus	544, 971
macrops	927
macropterum (Exoglossum)	130
macropterus (Centrarchus)	463
(Labrus)	464
macrorhynchus	377
macrostoma	177
Macrourus	811
macrourus (Alopias)	27
Macrozoarces	784
Macruridæ	810
Macrurus	811
macrurus (Ophichthys)	898
(Oxyodontichthys)	898
macularius	330
maculata (Amia)	930
(Eleotris)	632
(Etheostoma)	508
(Hemitremia)	162
(Lophopsetta)	816
(Morone)	483
(Perca)	540, 918
(Sciæna)	632
maculaticeps	492
maculatum (Aulostoma)	390
(Boleosoma)	492
(Cybium)	426
(Cynoscion)	581, 934
maculatus (Alvordius)	502, 503
(Apogon)	930
(Bodianus)	537
(Bothus)	815
(Clinus)	777
(Cryptacanthodes)	780
(Diodon)	863
(Dormitator)	632, 944
(Hadropterus)	502
(Heptranchias)	62
(Holocentrus)	540
(Hypeneus)	565
(Labrus)	581
(Lumpenus)	777
(Monoprion)	930
(Mullhypeneus)	565
(Mullus)	565
(Nothonotus)	508
(Notorhynchus)	34, 63
(Platypœcilus)	348
(Pleuronectes)	816
(Rhypticus)	543
(Scomber)	426
(Scomberomorus)	426
(Serranus)	540
(Stichæus)	777
(Upeneus)	565
maculocinctus	615
maculofasciatus	536
maculosa (Lota)	802
maculoseriatus	646
maculostriatus	864
maculosus (Acipenser)	87
(Centrarchus)	466
(Centridermichthys)	718
(Gadus)	802
(Oligocottus)	718
(Paralichthys)	821
(Pimephales)	159
Mademoiselle	570
mæandricus	749
magdalenæ	580
mainensis	394
majalis	332
major (Actinochir)	741
(Cyclopterus)	741
(Liparis)	741
(Ptychocheilus)	226
Malacanthidæ	619, 624
Malacosteus	287
Malasheganay	568
maliger	673, 674
malleus	26
Mallotus	291, 889
Malma	319
malma (Salmo)	319, 320
Malthæa	850
Malthe	850
Malthidæ	849
Mancalias	848
Man-eater Shark	30
Mangrove Snapper	549
manitou	500
Manjuari	92
Manta	52

	Page.
man'a	52
mapo (Gobius)	945
margaritatus	958
margaritus	235
margarotis	471
marginata (Uranidea)	698
marginatum (Ophidium)	792
marginatus (Brosmius)	796
(Brosmophycis)	796
(Dinematichthys)	796
(Halias)	796
(Hemirhamphus)	902
(Lepomis)	478
(Noturus)	100
(Pomotis)	478
marina (Perca)	652
marinus (Ælurichthys)	111
(Esox)	902
(Petromyzon)	10, 11, 867, 868, 869
(Sebastes)	651
(Silurus)	111
(Tylosurus)	902
marmorata (Pteroplatea)	47
marmoratus (Amiurus)	104
(Antennarius)	846
(Cottus)	700
(Cremnobates)	962
(Hemitripterus)	717
(Pimelodus)	104
(Rhinichthys)	207, 885
(Scorpænichthys)	716
Marsipobranchii	3, 57
Mascalongus	353
Muskallunge	353
masoni	313
massachusettensis	857
Mastacembelidæ	368
matamorensis	347
Mathemeg	882
mattowacca	267
matutinus	199
mauritii	449
Maurolicus	283
maxillaris	768
maxillingua	160
maxillosus (Gnathypops)	942
(Opisthognathus)	943
(Rhinichthys)	207, 208, 885
maximus	31, 61, 875
May fish	332
May Sucker	144
Meda	252
Medialuna	562
mediocris	266
medirostris	86
mediterranea (Sarda)	427
mediterraneus (Hoplostethus)	458
(Scomber)	428
medius (Anisarchus)	777
(Calamus)	928
(Clinus)	777
(Grammateus)	928
(Lumpenus)	777
(Stichæus)	777
megacephalus (Calamus)	926
megacephalus (Chitonotus)	699
(Icelus)	662
Megalocottus	707
Megalopinæ	261
Megalops	261
megalops (Alburnellus)	195
(Alburnus)	195
(Ditrema)	592
(Ennichthys)	592
(Minnilus)	195
(Pimelodus)	109
(Trycherodon)	247
megalotis	477, 478, 480
melampterus	309
melanocephalus	158
melanogaster	823
Melanogrammus	803
melanops (Bryttus)	468
(Calliurus)	467, 468
(Catostomus)	135, 136
(Dionda)	157
(Glossoplites)	468
(Haplochilus)	340, 894
(Hybognathus)	157
(Icthelis)	473
(Lepomis)	473
(Minytrema)	136
(Sebastes)	657, 658
(Sebastodes)	658
(Zygonectes)	340, 892
melanopterum	552
melanostictus	828
melanotis (Limamuræna)	356
(Muraena)	355, 894
melanotus (Catostomus)	159
melanura (Perca)	548, 921
melanurus (Exocœtus)	379, 904
(Lutjanus)	548, 921
(Ocyurus)	548
melas	104
meleagris	208, 885, 886
Meletta	264, 266
Melletes	716
Menidia	406, 908, 969
menidia (Atherina)	406, 407, 408, 909
(Atherinichthys)	407
Menhaden	269
menhaden	270
Menomonee White-fish	298
menona	335
Menticirrus	576
meridionalis (Amiurus)	106
(Bubalichthys)	116
(Cottus)	697
(Ictalurus)	106
(Sclerognathus)	116
(Uranidea)	697
merki	300
Merlangus	807
merlangus (Anoplopoma)	650
Merluccio	809
merluccius (Gadus)	809
Merlucius	808
Merou	539, 656
mertensi	700

	Page.
mesœus	492
mesogaster	377
Mesogonistius	471
Mesoprion	547
mesotrema	461
metallica	209
Metoponops	816
Metrogaster	588
mexicanum (Dorosoma)	887
mexicanus (Chatoëssus)	888
(Mugil)	403, 908
Michigan Herring	301
Grayling	303
Micristius	338, 340
Micristodus	32, 875
microcephalus (Gasterosteus)	395
(Somniosus)	14, 15, 57
Microgadus	805
microlepidotus	151, 152
microlepis	538
microlophus	482
Micrometrus	588, 936
Microperca	522
Micropogon	575
micropogon	212
microps (Calliurus)	473
(Caulolatilus)	626
(Corvina)	570
(Cottunculus)	688, 952
(Lepomis)	473
(Sparus)	928
Micropterus	484
Micropteryx	440
micropteryx	203
micropus (Clupea)	263
(Gasterosteus)	394
microstigmius	900
Microstoma	289, 889
microstoma (Cliola)	168
(Gasteropelecus)	289
(Uranidea)	698
Microstomus	838
microstomus (Citharichthys)	817
(Minnilus)	168
Midshipman	751
milberti (Arius)	110
(Carcharias)	23, 872
(Carcharinus)	22
(Eulamia)	60, 872
milesi	159
Miller's Thumb	693, 696
milneri (Calamus)	928
(Nocomis)	218, 219
(Pagellus)	556
(Sparus)	556, 928
milnerianus	243
mineopas	473
miniatum (Peristedium)	732
miniatus (Lepomis)	476
(Sebastichthys)	664
(Sebastodes)	663
minima (Abeona)	587, 588
Minnilus	185, 200
Minnow	242
Minomus	124
minor	781
minuta	698
Minytrema	135
mirabile (Exoglossum)	205
mirabilis (Clupea)	265
(Gillichthys)	636
(Phenacobius)	205
Mississippi Cat	108
Missouri Sucker	121
missuriensis	168, 169
mitchilli (Cottus)	702, 955
(Engraulis)	273, 888
(Stolephorus)	888
miurus	99
modesta (Cheonda)	242
modestus (Julis)	604
(Oxyjulis)	604
(Pseudojulis)	604
(Squalius)	242
Mojarra	611, 934
Mola	865
mola	866
Molacanthus	865
molestum	638
Mollienesia	346, 894
mollis	842
Molva	801
molva (Gadus)	801
Molvella	796
Monacanthus	856, 965
monachus	217
Mongrel White-fish	301
Moniana	163, 165, 173
Monk-fish	35, 844
Monolene	840
Monoprion	931
monopterygius (Aspidophoroides)	724
(Chirus)	642
(Cottus)	725
(Hexagrammus)	642
(Labrax)	642
Monosira	933
montagui	743
montana (Gila)	234
Montana Grayling	303
montanus (Clinostomus)	234
(Squalius)	234
(Thymallus)	303
Moon-eye	259, 260
Moon-fish	439
Moray	355
mordax (Atherina)	293
(Crotalopsis)	359
(Engraulis)	272
(Macrodonophis)	359, 897
(Muræna)	356
(Ophichthys)	897
(Osmerus)	293
moringa	895
morio	540, 919
Morone	530
Morrhua	804
morrhua (Gadus)	804

	Page.
morrisi	362
Mossbunker	269
Motella	796
moucharra	610
Mouse-fish	845
Moxostoma	132, 136
mucosa (Liparis)	744
mucosum (Xiphidion)	773
mucosus (Acanthocottus)	703, 955
(Lycodalepis)	788
(Lycodes)	788
(Neoliparis)	744
(Xiphister)	772
mucronata (Perca)	531
mucronatum (Ophidium)	767
mucronatus (Neoconger)	360, 900
Mud-cat	101, 102
Mud-dab	837
Mud-fish	94, 636
mudfish (Fundulus)	331
Mud-fishes	92, 350
Mud Minnows	349, 350
Mud Sun-fish	469
Muffle-jaw	696
Mugil	402
Mugilidæ	401
mugiloides	632
muikisi	313
Mullet	239
Mullets	401, 402
Mullidæ	564
Mullhypeneus	565
Mullus	564, 931
multifasciata	334, 335, 891, 892
multifilis	758
multilineata (Pœcilia)	347
multilineatus (Labrax)	530
multimaculatus (Diodon)	863
Mummichog	336
Mupus	914
Muræna	355, 894, 895
Murænidæ	355
engyschistæ	355
Murænoides	766
Murænopsis	359, 969
murinus	475, 476
musica	246
Musquaw River White-fish	299
Mustelus	19, 59, 870
mutatum	492
Myctophum	281
mykiss	313
Myliobatidæ	49
Myliobatis	50, 879, 880
Mylocheilus	224
Mylochilus	224
Myloleucus	244, 245, 887
Mylopharodon	225
myops	281
Myoxocephalus	706
Myrichthys	360
Myriolepis	649
Myrophis	899
mystacalis	475
mystinus	659
Mystriophis	358
Myxine	4
Myxinidæ	4
Myzonts	3
Myzopsetta	831

N.

	Page.
nacrea	230
namaycush	317, 890
Nanostoma	509
nanus	272, 888
Narcine	877
naresi	318, 319, 968
narinari	50, 879
Nassau Grouper	918
nasus	370
nasuta (Malthe)	850
nasutum (Campostoma)	149
nasutus (Argyreus)	207
(Leuciscus)	207
(Rhinichthys)	207, 885
natalis	105
Nauclerus	443
naucrateoides	417
Naucrates	443
naucrates (Echeneis)	416
(Leptecheneis)	417
Nautichthys	720
nebrascensis	212
nebulifer (Catostomus)	883
(Labrax)	537
(Paralabrax)	537
(Serranus)	536
nebuliferus (Catostomus)	883
nebulosa (Etheostoma)	500
(Sciæna)	577
(Umbrina)	577
nebulosus (Acantholebius)	644
(Centronotus)	768
(Chiropsis)	644
(Chirus)	644
(Clinus)	779
(Gasterosteus)	394
(Lycodes)	787
(Menticirrus)	577, 933
(Pimelodus)	105
(Sebastes)	676
(Sebastodes)	676
(Zeus)	456
Needle-fish	374
neglectus	568
Negrita	537
Nematognathi	95
Nemichthyidæ	365
Nemichthys	366
Neoclinus	760
Neoconger	360
neogæus	243
neohantoniensis	299
Neoliparis	744
Neomænis	549
nephelus (Lepomis)	475
(Tetrodon)	966
nerka	308
Nerophis	382

	Page.
nevisensis	502
newberrii (Eucyclogobius)	638
(Fario)	313
(Gobius)	638
(Lepidogobius)	637
New Light	464
newmani	497
nicholsi	946
nigellus	159
niger (Ammocœtes)	9, 867
(Astronesthes)	288
(Bubalichthys)	116
(Chiasmodon)	810
(Conger)	362, 363
(Cottus)	707
(Esox)	352
(Gasterosteus)	396
(Gobius)	633
(Malacosteus)	287
(Squalius)	239
Nigger-fish	541
nigra (Astronesthes)	287
(Elacate)	419
(Etheostoma)	492
(Gila)	239
(Sciæna)	572
(Tautoga)	599
nigrescens (Coryphæna)	917
(Cycleptus)	120
(Serranus)	916
(Squalius)	242
(Tigoma)	242
nigricans (Acanthurus)	617, 941
(Amiurus)	108
(Camarina)	560
(Catostomus)	130
(Centropristis)	533, 534, 917
(Chætodon)	941
(Girella)	560
(Huro)	485
(Hylomyzon)	131
(Hypoplectrus)	537, 918
(Ictalurus)	882
(Micropterus)	485
(Petromyzon)	11, 868, 869
(Pimelodus)	108
(Plectropoma)	537
nigrilabris	102
nigripinnis (Argyrosomus)	301
(Coregonus)	301
(Rhypticus)	920
nigritus	540, 541, 920
nigrocinctus	677, 678
nigrofasciata (Hydrargyra)	336
nigrofasciatus (Fundulus)	335
(Hadropterus)	506
nigromaculatus	465
nigromarginata	357
nigrotæniata	164
nigrotæniatus (Graodus)	164
(Hybognathus)	156, 884
nigrum (Bolcosoma)	492
(Petromyzon)	9
Nine-spined Stickleback	393
nitida (Moniana)	175
nitida (Pomotis)	478
nitidus (Alburnus)	202
(Centrarchus)	465
(Salvelinus)	321
nivea	180
niveatus	541
niveiventris	108
nobile (Atractoscion)	579
(Cynoscion)	933
nobilior (Esox)	353
nobilis (Conodon)	923
(Johnius)	579
(Gambusia)	346
(Heterandria)	346
(Perca)	551
(Pomadasys)	550
Nocomis	211
Nomeidæ	448
Nomeus	449
norvegica (Perca)	651, 652
norvegicus (Coryphænoides)	812
(Macrurus)	813
norwegicus (Sebastes)	652
notabilis	211
Notacanthidæ	370
Notacanthus	370, 900
Notarius	110
notata (Atherina)	408
(Atherinichthys)	407
(Belone)	373
(Cliola)	177
(Cyprinella)	178
(Dorosoma)	271
(Labrax)	530
(Malthe)	850
(Menidia)	407, 969
notatum (Chirostoma)	408
notatus (Hyborhynchus)	159
(Lepomis)	482
(Minnilus)	159
(Pomotis)	482
(Pimelodus)	109
(Porichthys)	752
(Semotilus)	340
(Tylosurus)	373
(Zygonectes)	339
Notemigonus	248
Nothonotus	506
nothum	580, 581, 934
Notidanidæ	62, 967
Notidanus	34, 62
Notogrammus	776
Notorhynchus	34, 62
notospilotus	690, 973
Notropis	185
nottii	341
Noturus	97
Novacula	605
novæ-angliæ	298
noveboracensis (Exocœtus)	379, 904
(Gasterosteus)	396
(Naucrates)	443
novemlineatus	757
novemmaculatus	863, 966
nubila (Apocope)	210

	Page.
nubila (Cliola)	167
nubilus (Alburnops)	167
(Argyreus)	210
(Centroblennius)	778
(Leptoblennius)	778
(Lumpenus)	778
(Stichæus)	778
nuchalis	155, 156, 157, 968
nuchipinnis	762
nuecensis	485
Numb-fishes	38, 39
nummifer	118, 119
nummularis	865
Nurse	15
Nurse-Sharks	17, 18
nuttalli (Exocœtus)	380, 381
Nyctophus	282

O.

obesa (Algansea)	245
(Tigoma)	237
obesus (Amiurus)	104
(Bryttus)	470
(Enneacanthus)	470
(Leuciscus)	245
(Leucus)	245
(Pomotis	470
(Squalius)	237
obliquus	574
oblonga (Chænopsetta)	823
(Platessa)	823
oblongum (Moxostoma)	134
oblongus (Cyprinus)	132, 134
(Paralichthys)	824
(Pleuronectes)	823, 824
(Pseudorhombus)	823
obolarius	396
obscura (Eulamia)	60
obscurus (Carcharias)	22, 872, 967
(Carcharinus)	22
(Centrarchus)	485
(Lepiopomus)	480
(Lepomis)	480
(Pomotis)	480
(Squalus)	22
obtusirostris	378
obtusa (Eulamia)	872
obtusus (Rhinichthys)	208, 885
(Squalus)	872
occidentalis (Abramis)	250
(Amia)	94
(Catostomus)	128
(Chorinemus)	447
(Conger)	363
(Gasterosteus)	393, 447, 973
(Girardinus)	349
(Heterandria)	349
(Leucosomus)	250
(Luxilus)	250
(Monacanthus)	856
(Notemigonus)	250
(Noturus)	100, 101
(Oligoplites)	447, 914, 973
(Scombroides)	447
(Torpedo)	39
Oceanic Bonito	430
oceanica (Anguilla)	363
oceanicus (Conger)	363
(Gobionellus)	636, 947
(Gobius)	636
ocella	885
ocellaris (Chaenopsetta)	823
(Fundulus)	891
(Paralichthys)	972
(Platessa)	822, 972
(Pseudorhombus)	822, 972
ocellata (Corvina)	571, 572
(Gymnothorax)	357
(Muræna)	356
(Perca)	572
(Raia)	40
(Sciæna)	571, 931
ocellatus (Acanthocottus)	955
(Anarrhichthys)	782
(Citharichthys)	964
(Hemirhombus)	964
(Herpetoichthys)	359
(Hippoglossus)	964
(Murænoides)	766
(Murænopsis)	359
(Ophichthys)	359
(Zeus)	457
ocellatum (Ophidium)	766
ocellicauda	94
octodecimspinosus	701
octofilis	413
Octogrammus	641
octogrammus	641
octonemus	413
oculatus	479
oculofasciatus	721
Ocyurus	548
Odontaspididæ	874
Odontaspis	27, 874
Odontopyxis	729
ogac (Gadus)	804
Ohio Shad	266
Ohio Sturgeon	87
Old-wife	574
olidus (Hypomesus)	294, 295
oligaspis	200
Oligocottus	717
Oligocephalus	514
Oligoplites	447, 913, 973
olisthostoma	934, 935
olivacea (Pœcilia)	340
olivaceus (Pimelodus)	109
olivaris	102, 881
olmstedi	492
ommatus	824
omocyaneus	632
omostigma	963
Oncocottus	704
Oncorhynchus	304
Oneirodes	848
Onirodes	848
onitis	600, 936
Onos	796
Opah	453
Ophichthys	358, 969

	Page.
Ophidiidæ	792
Ophidium	792, 963
Ophioblennius	756
Ophiodon	646
Ophisurinæ	357
Ophisurus	358, 898
ophryas	822, 972
ophthalmicus	475
Opistharthri	967
Opisthognathidæ	942
Opisthognathus	943
Opisthomi	368
Opisthonema	268
Opladelus	101
Oplopoma	646
Opsopœodus	246
oquassa	318, 968
Oquassa Trout	318
orbis	747
Orcynus	428
ordinatus	642, 643, 949
oreas	154
oregonensis	226
orientalis (Anarrhichas)	782
(Oncorhynchus)	307
(Pelamys)	428
(Salmo)	307
ornata (Aphoristia)	843
(Cliola)	173
(Codoma)	173
(Embiotoca)	595
(Raia)	877
ornatum (Campostoma)	149
ornatus (Achirus)	843
(Cochlognathus)	161
(Esox)	352
(Gunnellus)	768
(Murænoides)	767
Ornichthys	734
Orthagoriscidæ	864
Orthagoriscus	865
Orthodon	151
Orthopristis	551
Orthopsetta	816
oscula (Apocope)	211
(Corvina)	568
osculatii	530
osculus (Argyreus)	211
osmerinus	156
Osmerus	292
osseus	90, 91, 880
osteochir	418
osteosticta	66
Ostraciidæ	852
Ostracium	853
Oswego Bass	484
Othonops	639
Otolithinæ	566
Otolithus	580
otsego	299
ouatalibi	541
ovalis	660, 661
ovatus	442, 912
ovinus	329
ovis	559
Oxyjulis	604
Oxylebius	648
oxygeneios	532
oxygenius	532
Oxylabrax	528
Oxymetopontinæ	949
Oxyodontichthys	898
oxyptera	916
Oxyrhina	28
oxyrhynchus (Carcharias)	23
(Isurus)	28, 29, 61, 874, 875
(Acipenser)	86
oxyurus	91
Oyster-fish	600, 750

P.

pachypus (Cottus)	702
pacificus (Argyreiosus)	440
(Cynicoglossus)	839
(Glyptocephalus)	839
(Lycodes)	785
(Lycodopsis)	785
(Orcynus)	429
(Salmo)	291, 292
(Thaleichthys)	292
(Thynnus)	429
Paddle-fish	82
pætulus	964
Pagellus	556, 972
Pagrus	556, 972
pagrus (Sparus)	556, 928
Palinurus	452
Palinurichthys	452
palladus (Labrus)	480
pallasi (Monacanthus)	865
(Octogrammus)	641
(Pleuronectes)	836
Pallasia	865
pallida (Lepomis)	485
pallidus (Eupomotis)	482
(Labrax)	531
(Lepomis)	479
(Leucosomus)	221
(Platygobio)	220
(Pomotis)	482, 483
(Semotilus)	221
palmipes	734, 735
Pammelas	452
pampanus	442
pandionis	564
pandora	235
pantherina (Oplopoma)	646
pantherinus (Anarrhichas)	781
(Ophiodon)	646
Pantosteus	121
papalis	157
papilio	716
papillifer	890
papilliferus	890
papillosum	137, 138
paradoxus	687
Paragonus	729
Paralabrax	535
Paralepididæ	276
Paralepis	277, 278

	Page.
Paralichthys	821
Paranthias	973
Parascorpæna	678, 679
parasiticus	363
Paratractus	433, 970
pardalis	858
pardus	751, 958
Parephippus	613
Parepinephelus	537
Pareques	573
parietalis	158
parkei	320
Parma	610
parmatus	682
parmifera	878
Parophrys	831
parovanus	246
parræ	553
parrii	789
Parrot-fish	606
paru (Pomacanthus)	616
(Stromateus)	914
parva (Lucania)	343, 893
parvipinne (Cynoscion)	580
parvipinnis (Fundulus)	333
parvus (Centridermichthys)	695
(Cottopsis)	695
(Cyprinodon)	343
(Sebastes)	671
pastinaca	47, 48
patatus	603
patris	708
patronus	269
patruelis	345, 892, 893
paucidens (Leurynnis)	785
(Lycodopsis)	785
(Oncorhynchus)	309
(Salmo)	309
paucispinis	652, 656, 657
pavonaceus	939
paxillus	785
Pêche Prêtre	659
peckianus (Syngnathus)	383
pectinatus (Pristis)	72, 875
pectinifer	762
pectoralis (Dallia)	351
Pediculati	843
Pegador	416
Pelamys	427
pelamys	428, 430
pellucida (Ammocrypta)	489
pellucidum (Etheostoma)	490
pellucidus (Pleurolepis)	490
(Thyris)	840
Pelodichthys	102
peltastes (Lepomis)	478
peltatus	503
peninsulæ	408, 969
pennatula	926
pensacolæ (Harengula)	268
pentacanthus	459
pepo (Scarus)	606
Peprilus	450
perarcuatus	832
Perca	523, 916
Percarina	488
Percesoces	397, 401
Perch	523, 595
Perches	486
Percichthys	486
Percidæ	486
perciformis	452, 453
Percilia	488
Percina	499
Percinæ	488
percobromus	202
Percomorphi	397
Percopsidæ	322
Percopsis	322
perfasciatus	273, 274
periscopus	807
Peristediinæ	732
Peristedion	732
Peristedium	732
peristethus	731
Permit	912
Peropus	719
personatus	415, 909
perspicabilis	595
perspicillum	787
perspicuus	159
Pesca Vermiglia	668
Pescadillo del Rey	409
Pescadito	235
Pesce-rey	604
Petromyzon	10, 867, 868
Petromyzontidæ	6, 867
petrosus (Mugil)	404
(Serranus)	918
(Trisotropis)	918
phalæna	578
Phalangistes	728
phaleratus	353
Phanerodon	594, 595
Pharyngognathi	397
phasganorus	900
phenax	474
Phenacobius	205
philadelphicus	973
Philypnus	630, 944, 972
phlebotomus	941
phlegethontis	244, 887
phlox	495
Phobetor	708
Pholis	760
Photogenis	163, 179
photogenis	201
Phoxinus	242
phoxocephalus	501
Phthirichthys	969
Phycis	798
Physiculus	800
physignathus	219
Physoclisti	367
Physostomi	94
Pickerel	352, 353
Picorellus	352
picturatus	911
pictus (Chaunax)	847
(Chiropsis)	645

	Page.
pictus (Chirus)	645
(Gymnelis)	789
(Julis)	938
(Oxylebius)	648
(Platyglossus)	938
Picuda	412
picuda (Sphyræna)	412
pidiense	138
Pig-foot	681
Pike	226, 351, 352
Perch	525
pilatus	735
Pileoma	499
Pilodictis	101, 881
pilosus	862
Pilot-fish	298
Pilot-fishes	430, 443
Pimelepterinæ	546
Pimelepterus	560, 972
Pimelode livrée	100
Pimelometopon	601, 602
Pimephales	158
Pin-fish	558
pingeli	713
pinguis	819
pini	733
pinnatus	364
pinniger (Enneacanthus)	471
(Sebastodes)	662
(Sebastichthys)	663
(Sebastosomus)	663
pinnulatus	446, 913
Pipe-fish	382
piptolepis	183
Pirate Perch	460
piscatorius	844
Pisces	73
pisculentus	336
Pisodontophis	899, 969
pisonis	631
Pisoodonophis	899
pisquetus	435, 912
pistilliger	708
pituitosus	543
pixanga	920
placitus	157
Placopharynx	142
plagiusa	843
Plagopterinæ	148
Plagopterus	253
Plagyodus	275
Plaice	831
plana	837
planeri	7
Plargyrus	185, 250
Platessa	831
platessoides	826
Platichthys	831, 835
Platirostra	83
platorhynchus (Acipenser)	88
platostomus (Lepisosteus)	91
platycephalus (Amiurus)	103
(Cottus)	706
(Megalocottus)	707
(Noturus)	101
platycephalus (Pimelodus)	104
Platyglossus	602
Platygobio	219
platyodon	872, 873, 967
Platypodon	967
Platypœcilus	348
Platyrhina	876
Platyrhinoidis	876
platyrhynchus (Minomus)	122, 124
platyrrhynchus (Pantosteus)	123
(Scaphirrhynchops)	88
platystomus (Lepidosteus)	91
Platysomatichthys	819
plebeius (Catostomus)	122
(Gasterosteus)	395
(Pantosteus)	122
plebejus (Mustelus)	870
Plectognathi	852
Plectospondyli	111
plectrodon	958
Plectropoma	537, 917
pleii	903
Plesioperca	505
Pleuracromylon	59, 870
pleuriticus	314
Pleurogrammus	641, 949
Pleurolepis	488
Pleuronectes	831
Pleuronectidæ	813
pleurophthalmus (Antennarius)	846
Pleuronichthys	828
pleurostictus	713
plumbea (Chimæra)	54
(Dionda)	155
(Lampetra)	8, 57
plumbeolus	192
plumbeum (Zophendum)	155
plumbeus (Ammocœtes)	867
(Carcharias)	872
(Ceratichthys)	219
(Gobio)	219
(Petromyzon)	8
(Squalus)	872
plumieri (Chætodon)	613
(Conodon)	551
(Diabasis)	971
(Gerres)	583, 935, 936
(Labrus)	971
(Mugil)	403
(Polydactylus)	413
(Polynemus)	413
(Sciæna)	551
(Scomberomorus)	426
(Scorpæna)	680
(Trichidion)	413
plumierianus	432, 912
plutonia	878
pneumatophorus	424, 910
Podothecus	729
Pœcilia	347
Pœcilichthys	514
Pœciliinæ	327
Pœciliodes	344
pœcilioides	347, 894
Pœcilurichthys	255

	Page.
pœcilurum	141
poeyi (Platyglossus)	938
Pogonias	568
Pogonichthys	223
Pogostoma	880
polaris (Blennius)	788
(Boreogadus)	807
(Cottus)	706
(Lycodalepis)	788
(Lycodes)	788
(Merlangus)	807
Polistotrema	867, 967
politus (Seriphus)	582
(Tetrodon)	860, 861
Pollachius	806
Pollack	806
pollicaris	954
polyacanthocephalus	703
polyactocephalus	765
Polynemidæ	412
Polynemus	413, 969
Polyodon	83
Polyodontidæ	82
Polyprion	532, 916
polytrema	657
Pomacanthus	615
Pomacentridæ	609
Pomacentrus	609, 939
Pomadasys	550, 923
Pomatomidæ	447
Pomatomus	448
Pomatopsetta	825
Pomolobus	265
Pomotis	472
pomotis	469
Pomoxys	464
Pompano	441
Pompano (California)	451
ponderosus	108
Pontinus	678, 679, 951
popei	478
Porbeagle	28
Porcupine-fish	862
porcus	681, 951
Porgee	556, 557, 597, 613
Porichthys	751, 958
Porocottus	707
Poronotus	450, 451
porosissimus (Porichthys)	751, 752, 958
porosus (Cottus)	703, 955
(Esox)	352
Potamocottus	695
Potamotrygon	72
potsii	517
powelli	855
præcisus	774, 775
præstabilis	268
pretiosus	294, 295
Priacanthidæ	544
Priacanthus	544
princeps	625
principis	603
Prionodes	917
Prionodon	22
Prionotus	733, 956
Pristidæ	36
Pristigaster	262
Pristipoma	550
Pristipomatidæ	545, 880
Pristipomatinæ	546
Pristis	37, 875
pristis	37
Proarthri	967
probatocephalus	559
procne	169
productus (Merlucius)	809
(Gadus)	809
(Merlangus)	809
(Rhinobatus)	38, 63, 876
prœliaris	522
profundorum	793, 794
prolixum	150
promelas	158
Promicrops	541, 920
Promicropterus	543
proriger (Clinostomus)	232
(Gila)	232
(Leuciscus)	232
(Sebastichthys)	662
(Sebastodes)	661, 950
proserpina	175
Prosopium	297
prosthemius	219
protacanthus	465
proteus	305
Protoporus	203
proximus	805, 806
pruinosa	806
Psettichthys	825, 828
pseudoharengus	267
pseudohispanica	887
Pseudojulis	604
Pseudopleuronectes	831, 837
Pseudopriacanthus	545
Pseudorhombus	821
Pseudoscarus	606
Pseudosciæna	569
Pseudosebastes	678
Pseudoxiphophorus	344
Pseudupeneus	565
psittaculis (Julis)	937
psittacus	601
Psychrolutes	686
Psychrolutidæ	683
Psychrolutinæ	683
Pteraclis	455
Pterophryne	845
Pterophrynoides	845, 965
Pteroplatea	46
Ptilichthys	369
Ptychocheilus	225
Ptychostomus	136
Ptyonotus	709
Puffer	859, 861
pugettensis	692
pugetti	395
pulchella (Liparis)	741
(Moniana)	175
(Tigoma)	238
pulchellus (Astatichthys)	518

	Page.
pulchellus (Chilonemus)	222
(Engraulis)	273
(Haplochilus)	340
(Leuciscus)	222
(Leucosomus)	222
(Oligocephalus)	517
(Squalius)	238
(Zygonectes)	340
pulcher (Labrus)	602
(Pimelometopon)	602
(Semicossyphus)	602
(Squalius)	236
(Trochocopus)	936
pulchra (Harpe)	602
(Tigoma)	236
pullum (Chondrostoma)	149
pullus (Amiurus)	104
(Monacanthus)	858
(Pimelodus)	104
pulverulentus	245
Pumpkin-seed	482
punctata (Gambusia)	344
(Girella)	560
(Lamna)	29, 875
(Perca)	541, 571
(Sciæna)	570, 931, 932, 933
(Trigla)	734
punctatum (Myctophum)	281
punctatus (Aprionodon)	24, 874
(Blennius)	758, 775
(Bodianus)	919
(Bryttus)	476
(Caranx)	432
(Carcharias)	24
(Decapterus)	432, 912
(Enneacentrus)	541
(Epinephelus)	541
(Holocentrus)	918, 920
(Ictalurus)	108, 882
(Isesthes)	758
(Lepomis)	476
(Micristodus)	32, 875
(Myrophis)	900
(Osmerus)	294
(Phycis)	798
(Prionotus)	734, 956
(Silurus)	109
(Squalus)	24, 874
(Stichæus)	775
puncticulatus (Apogonichthys)	931
punctifer (Crotalopsis)	359, 897
(Hybognathus)	884
(Ophichthys)	358
punctipinne (Siphostoma)	385, 905
punctipinnis (Ayresia)	612
(Chromis)	611, 939
(Dermatostethus)	385
punctulata (Coryphæna)	454, 914
(Microperca)	523
(Uranidea)	696
punctulatus (Calliurus)	485
(Lampugus)	454, 914
(Minnilus)	198
(Nothonotus)	516
(Pimelodus)	102
punctulatus (Pœcilichthys)	516
(Potamocottus)	696
pungitius	393
puniceus	155
purpurascens (Lepomis)	480
purpuratus (Salmo)	313, 314, 315
purpurea (Tigoma)	238
purpurescens (Anoplarchus)	771
purpureus (Merlangus)	807
(Squalius)	238
putnami	498, 837
pygmæa (Umbra)	350
pygmæus (Gadus)	807
(Gasterosteus)	394
(Leuciscus)	350
Pygosteus	393
pyrrhomelas (Cliola)	184

Q.

quadracus	396
quadratus	613
quadricorne (Ostracium)	854
quadricornis (Agonus)	723
(Aspidophorus)	723
(Cottus)	704
(Hypsagonus)	722
(Oncocottus)	705
(Ostracion)	854
quadrifasciatus	757
quadrifilis (Cottus)	707, 708
quadrilateralis (Coregonus)	298
quadrilineatum (Hæmulon)	554
quadriloba	51
quadrimaculatus	863
quadriseriatus	691
quadrituberculatus	829, 836
quadrocellatus	824, 825
Quassilabia	143
quatuordecemlaminatus	417
Queen-fish	582
quiescens	699
Quill-back	120
quinnat	307
quinquecinctus	616

R.

Rabbit-fish	863
Rabbit-mouth Sucker	144
radians (Scarus)	939
radiata (Raia)	41
radiatus (Chœrojulis)	603
(Platyglossus)	603, 973
(Sparus)	603, 973
rafinesquei	88
Raia	39, 877, 878
Raiæ	36
Raiidæ	39, 876
Rainbow Darter	514, 517
Rainbow Trout	312
Raja	40
raji	915
ranula	742
Ranzania	966
rapax	226
Rascacio	678, 680

	Page.
rascacio	681
Rasciera	663
Rasher	663
rastrelliger	671, 672
Rat-fish	54
Rat-tail	811
raveneli	352
Ray	36, 39
Razor-fish	605
Red Bass	571
Red-eye	466, 473
Red-eyed Bream	468
Red Fall-fish	189
Red-fin	186
Red-fish	196, 308, 602, 651, 931
Red Grouper	540
Red Gurnard	733
Red Horse	136, 140, 571
Red Minnow	153
Red-mouth	553
Red-mouth Buffalo-fish	114
Red Roncador	572
Red Snapper	549
Red-spotted Trout	319
regale (Cybium)	426
(Cynoscion)	581, 934
regalis (Enchelyopus)	798
(Johnius)	581
(Otolithus)	581
(Phycis)	798
(Scomber)	426
(Scomberomorus)	426
regius (Blennius)	798
(Hybognathus)	156
(Phycis)	798
Reina	669
reinhardi (Careproctus)	740, 957
(Liparis)	740, 957
reinhardti (Corynolophus)	849
(Himantolophus)	849
(Motella)	797
(Onos)	797
Reinhardtius	819
Remora	416, 417, 909
remora	417, 909
Remoropsis	417
Reniceps	25, 874
reticulata (Spatularia)	84
reticulatus (Bryttus)	476
(Chilomycterus)	966
(Esox)	353
(Gobiesox)	749
(Halieutichthys)	851
(Lepadogaster)	744
(Lycodes)	787
(Pseudoxiphophorus)	344
(Trygon)	72
retifer (Scylliorhinus)	869
retifera (Muræna)	894
retiferum (Scyllium)	870
retropinnis	126
Rhacochilus	596
Rhamphocottinæ	684
Rhamphocottus	721
Rheocrypta	497
rhessodon	749
Rhina	35
rhina (Raia)	43
Rhinæ	967
Rhinichthys	206, 884
rhinichthyoides	210
Rhinobatidæ	37, 876
Rhinobatus	37, 63
Rhinodontidæ	31, 875
Rhinonemus	796, 797
Rhinoptera	51
Rhinoscion	573
Rhinotriacis	20, 59, 60, 870
rhodochloris	667, 668
rhodorus	686
rhodoterus	592
rhomaleus	240, 886
rhombeus	934
Rhombochirus	417
rhomboides	558
Rhomboplites	549
Rhombus	450, 451, 815
rhothea (Uranidea)	953
rhotheus (Semotilus)	222
rhynchæus	87
Rhynchichthys	459
Rhypticinæ	528
Rhypticus	543
ricei	694, 953
richardi (Caranx)	437
(Hemirhamphus)	376
(Salmo)	309
richardsoni (Coregonus)	299
(Corvina)	568
(Cottus)	697
(Eutychelithus)	568
(Rhamphocottus)	722
(Trachidermus)	695
(Uranidea)	696, 697, 953
Richardsonius	251, 884
Ringed Perch	524
ringens (Engraulis)	272
(Stolephorus)	272
(Sudis)	277
Rio Grande Trout	314
rissoi (Trachurus)	911
River Chub	212
rivoliana (Seriola)	444
Roach	244
Robalo	528
robusta (Gila)	228
robustus (Clypeocottus)	711
(Ichthælurus)	109
(Leuciscus)	228
(Mylopharodon)	225
Roccus	528
rochei	425, 911
Rock	529
Rock Bass	466, 535
Rock-cod	652
Rock-fish	332, 499, 529, 650, 652
Rockling	796
Rock Salmon	444, 913
Rock Trout	641, 645
Rocky Mountain White-fish	297

	Page.
Roncador	572, 574, 928
roncador (Umbrina)	576
Ronchil	619, 623
rondeleti (Carcharodon)	30, 61, 875
(Exocœtus)	904
(Scomberesox)	375
rosaceus (Cymatogaster)	590
(Micrometrus)	589
(Sebastes)	663, 667
(Sebastodes)	663, 666
rosæ	376
roseus (Blennius)	766
(Centronotus)	766
(Gunnellops)	766
(Luxilus)	189
(Minnilus)	189
Rose-fish	651
rossi (Lycodes)	787
(Salvelinus)	321
(Salmo)	321
rostrata (Anguilla)	361
(Muræna)	361
(Platessa)	834
rostratus (Agonus)	726
(Alepocephalus)	257
(Brachyopsis)	726
(Heterostichus)	764, 962
(Leptagonus)	955
rothrocki	776
rotunda	865, 866
rotundatum	289
Round-fish	298
Round Herring	263
Round Robin	432
Roussette	58
rubellus	202
ruber	665
ruberrimus	766
rubicunda (Parma)	610
rubicundus (Acipenser)	87
(Glyphisodon)	610
(Hypsypops)	610
(Pomacentrus)	610
rubricauda	477
rubricroceus	189, 190
rubrifrons (Alburnellus)	203
(Alburnus)	203
(Ceratichthys)	214
(Leuciscus)	203
(Minnilus)	202
(Nocomis)	215
(Notropis)	203
(Zygonectes)	338
rubripinna (Cliola)	884
(Cyprinella)	884
rubripinnis (Minnilus)	198
rubrivinctus	669
Rudder-fish	445, 452
rufa (Harpe)	601
rufilineatus	508
rufus (Bodianus)	602
(Cossyphus)	602
(Labrax)	531
rufus (Labrus)	602
rugosus	836
rupertianus	87
rupestris (Ambloplites)	466
(Bodianus)	466, 467
(Coryphæna)	811
(Coryphænoides)	812
(Labrus)	599
(Macrurus)	811
(Xiphister)	773
rutila	175

S.

sabina	49, 68, 879
Sabre-fish	910
saburræ	958
Saccopharyngidæ	365
Saccopharynx	365
Sacramento Perch	466
Salmon	306
Sturgeon	86
Sadina	265
sagax (Clupea)	265
sagitta	639, 640
saida	807
Sail-fish	120, 421
Sailor's Choice	551
saira	375
Salar	309, 312
salar	309
sallæi	164
Salmo	309
Salmon	288, 309, 312, 525
salmonea (Perca)	526
salmoneum (Stizostedium)	525
salmoides	484, 485
salmoneus (Esox)	352, 894
(Scombrocottus)	650
Salmonidæ	288
Salmon-killer	396
salmonoides	485
Salmon-Trout	313
Salmon-Trout of the Columbia	314
saltator	448, 914
saltatrix	448, 914
saludana	170
Salvelinus	316, 318
sanctæ-crucis	938
Sand Eel	414
Sand-dab	834
Sand Darter	488, 489
Sand-fish	626, 627
Sand-flounder	815
Sand Launce	414, 415
Sand-pike	280, 526
Sand-shark	27
sanguifluus	507
sanguineus	770
sanguinolentus (Oncorhynchus)	308
(Pomotis)	478
(Salmo)	308
sapidissima (Alosa)	268
(Clupea)	267
sapidissimus (Coregonus)	299
Sarcidium	205
Sarda	427
sarda (Pelamys)	428

	Page.
Sardine	266
Sardinia	887
Sargo	551, 930
Sargus	557
Sarothrodus	614
Sarpo	750
satiricus	761
saturna	572, 573
Sauger	526
Saurel	431, 432
Saurina	279
Saurus	279
saurus (Elops)	261, 968
(Oligoplites)	973
(Scomberesox)	375
(Trachurus)	432, 912
Saury	374
Saw-fish	36, 37
Saw-kwey	306
saxatilis (Chætodon)	611
(Glyphidodon)	611, 939
(Pœcilichthys)	515
(Pomacentrus)	611
saxicola	837
sayanus	460, 461
sayi	48, 69, 879
Sayris	347
scaber	644, 949
scabriceps	194
Scad	432
Scamp	538
Scaphirhynchus	88
Scaphirrhynchops	88
scaphiurus	943
Scarinæ	598
Scarus	607, 938
Scatophagus	673
scepticus	200
Schilbeodes	98
schœpffi	858
schranki	925
Schuylkill Cat	104
sciadicus	342
Sciæna	569, 931
Sciænidæ	566
Sciæninæ	566
Sciænops	571
scitulus	956
Sclerodermi	853
Sclerognathus	117, 883
Scoliodon	24, 60
scolopaceus	366
scolopax	388
Scomber	422
scomber	424
Scomberesocidæ	371
Scomberesox	374
Scomberomorus	425
Scombridæ	422
Scombrocottus	649
Scombroides	446, 913
Scombroidinæ	431
scombrus	424, 911
Scopelidæ	275, 279
Scopelus	281

	Page.
Scophthalmus	815
scopiferum	205
Scorpæna	678, 950, 951, 952
Scorpænichthys	716
Scorpænidæ	650
scorpioides	702
Scorpion	679
Scorpis	562
scorpius	702
scouleri	304, 305, 308
scripta	859
scrutator (Belone)	374
(Isesthes)	960
Sculpin	679, 682, 702
Scup	557
Scuppaug	557
scutellatus	375
scuticaris	358
scylla	168
Scylliidæ	57, 58
Scylliorhinus	58, 869
Scyllium	58, 869
Scymnidæ	13
Scyris	438
Scytalina	790
Sea Bass	526, 532
Sea-bat	850
Sea Catfish	109, 110, 111
Devil	52
Horse	386
Poacher	728
Raven	685
Robin	733
Trout	579, 580
Snail	738
Sebastapistes	678
Sebastes	651
Sebastichthys	652, 655, 670
Sebastodes	652, 653, 656, 950
Sebastomus	652, 654, 664
Sebastoplus	652
Sebastosomus	652, 654, 657
sectatrix	561
secundodorsalis	429
segaliensis	723
Selache	31
Selachians	12
Selachii	12
Selachostomi	82
Selar	433, 434
Selene	439
selene (Carpiodes)	120
(Luxilus)	188
(Minnilus)	188
selenops	260
semicinctus	603, 604
semifasciata (Etheostoma)	500
semifasciatum (Pileoma)	500
semifasciatus (Triacis)	20
seminolis	334
seminuda (Gila)	230
seminudus (Lycodes)	787
semiscabra	695
Semotilus	220
senilis	346, 894

	Page.
Señorita	604
senticosa	851
serena	157
Sergeant-fish	909
Seriola	444, 912, 913
Seriolichthys	446
Seriphus	582
serpentinus	778, 779
serra	276
Serranidæ	526
Serraninæ	527
Serrano	534
Serranus	532, 916, 917
serrata (Fistularia)	390
serratum (Hæmulon)	924
serratus (Gasterosteus)	396
serriceps	676, 677
Seserinus	914
sessilicauda	840
setapinnis (Zeus)	440
Setarches	682
setifer	857
setipinnis	440
sexmaculatus	863
Shad	267
Shad Waiter	298
Sharks	12
Sheepshead	558, 567
Shiner	185, 186, 232, 248, 250, 587
Shovel-head Shark	25
Shovel-nose	27
Shovel-nosed Shark	62
Sturgeon	88
shumardi (Alburnops)	193
(Hadropterus)	499
(Imostoma)	498
(Minnilus)	192
sialis	98
Siboma	230, 239
sicculus	406
Sidera	969
siderium	154, 155
Sierra	427
signatus	623
signifer (Bry'tus)	473
(Coregonus)	...
(Salmo)	303
(Stypodon)	224
(Thymallus)	302, 303
Siluridæ	96
Silus	295
Silver Chub	222
Eel	910
Silver-fin	163, 179
Silver Perch	570
Salmon	307
Trout	316
Silversides	404
sima	170
Simenchelys	363
similis (Amphistichus)	593
(Fundulus)	333, 891
(Hydrargyra)	333
simillimus	451
simotera	496
simpsoni	109
simulans (Enneacanthus)	470
(Hemioplites)	471
(Sebastosomus)	658
simus (Alburnellus)	170
(Rhinichthys)	885, 886
Siphagonus	725
Siphostoma	382, 904, 905, 906
siscowet	317, 318
Skate	39, 40
Skim-back	120
Skip-jack	266, 406, 432, 448
Skipper	375
Skittle Dog	16
Skowitz	307
Sleeper	631, 632
Sleeper-shark	13, 14
Sleepmarken	5
sloani	284, 285
Small-mouthed Black Bass	485
Smaragdus	635
Smelt	292, 293
smiridus	809
smithii (Carcharodon)	875
(Cyprinus)	260
Smooth Hound	19
Snapper	547, 651
Snipe Eel	365
Snipe-fish	388
Snooks	909
Soap-fish	543
socius	195
Soft-rayed fishes	94
sogo	459
Soldier-fish	517
Sole	841
Solenostomatidæ	381
solis	477, 478
Somniosus	14, 57
somnolenta	632
sonoriensis	349
soporator	633, 634, 944
sordidus	817
Southern Porgee	929
spadicea	155
spallanzani	28, 29, 874, 875
Spanish Flag	669
Mackerel	426, 910
Porgy	939
Sardine	887
Sparada	588, 590
Sparidæ	545, 880
Sparinæ	546
Sparisoma	938
sparoides	465
Sparus	555, 925, 972
spathula (Polyodon)	83, 84
(Squalus)	84
spatula (Lepisosteus)	92
Spatularia	83
Spawn-eater	171
Spear-fish	120, 420
speciosa (Gambusia)	346, 894
speciosus (Pomotis)	480, 482
(Semotilus)	221

	Page.
speciosus (Trachichthys)	458
Speck	495
Speckled Trout	320
spectabilis (Pœcilichthys)	518
(Salmo)	320
(Salvelinus)	320
spectrum	294
spectruncula	166, 167
spelæus	324
spengleri	861
spet	411
Sphagebranchus	358
Sphyræna	410
sphyræna (Esox)	410, 411
sphyrænarum	970
Sphyrænidæ	410
Sphyrna	26, 874
Sphyrnidæ	25
spillmani	506
spilonotus	857
spilopterus (Citharichthys)	817
(Leuciscus)	179
(Photogenis)	179
spilota	694, 953, 954
spilurus	314
Spinacidæ	15
spinarella	738, 957
spinicephalum	149
spinosissimus	727
spinosus (Calycilepidotus)	715
(Cyclopterus)	746
(Echinorhinus)	14
(Eumicrotremus)	745, 957
(Hemilepidotus)	714
(Squalus)	14
Spiny Eels	368
Spiny-rayed fishes	397
Split-tail	223
Split-mouth Sucker	144
Spoon-bill Cat	83
Spot	574
Sprat	274
Spratella	264
Spratelloides	263
Squali	12, 967
squalidus (Scarus)	938
squalipeta	909
Squalius	230
Squalus	16
squamatus	241
squamiceps	514
squamilentus (Ceratichthys)	218
(Couesius)	218
(Paralichthys)	823
Squamipinnes	613, 614
squamipinnis (Gerres)	935
Squatina	35
squatina	35
Squatinidæ	35, 967
Squeteague	581
Squirrel-fish	457, 459, 534
Squirrel Hake	799
stagnalis	321
Star-gazers	627
stearnsi (Blennius)	961

	Page.
stearnsi (Corvina)	572
(Lutjanus)	549, 921, 922
(Roncador)	572
(Sciæna)	572
(Scorpæna)	951
(Seriola)	445, 913
Steel-head	313, 314
stegophthalmus	723
stellaris	58
stellatus (Fario)	315
(Salmo)	315
(Platichthys)	836
(Pleuronectes)	835
stelleri (Cyclopterichthys)	745
(Cyclopterus)	745
(Trichodon)	627
stellifer (Bodianus)	569
(Fundulus)	337
stellifera (Corvina)	570
(Sciæna)	569, 931
(Xenisma)	337
Stelliferus	569
stellulata	44
Stenodus	304
Stenotomus	557, 929, 972
Stephanolepis	856
stephanophrys	736
Stereolepis	531
Sterletus	85
sterletus	216
Sternoptychidæ	283
stevensi	291, 292
Stichæus	775
Stichæidæ	754
Stickleback	392, 395, 396
stigma	789
stigmæa (Ulocentra)	495
stigmæus (Citharichthys)	965
stigmaticus (Ceratichthys)	212
(Gobionellus)	947
(Smaragdus)	947
stigmatura (Cliola)	182
(Codoma)	182
stigmaturus (Gobius)	946
(Photogenis)	182
Stilbe	248
Stilbius	250
stilbius	201
Stingaree	47
Sting Rays	45, 47
Stizostedion	525
Stizostedium	525, 916
Stoasodon	879
Stolephorus	272, 888
Stomias	286
stomias (Atheresthes)	820
(Platysomatichthys)	821
(Salmo)	316
(Trisotropis)	918, 972
Stomiatidæ	285
Stomodon	809
Stone-bass	532
Stone-cat	97, 100
Stone-lugger	130, 149
Stone Roller	130, 148, 149

	Page.
Stone-toter	160
storeri (Leuciscus)	221
(Scomberesox)	375
storeriana	170, 171
storerius	465
stouti	6, 57, 867
straminea	167, 168
Strawberry Bass	465
striatus (Anthias)	919
(Epinephelus)	918
(Roccus)	528
(Serranus)	919
strigatus	736
Striped Bass	529
Mullet	403
Stromateidæ	449
Stromateus	450
stromi	813
strumosus	749, 957
Stud-fish	337
Sturgeon	82, 84
sturio	85
stylifer	907
Stypodon	223
suavis	176, 177
subbifurcatus	775
subligarius	535, 917
subterraneus	325
sucetta	132, 133, 134
Sucker	112, 124, 578
sucklii	17
Sudis	277
sueuri	455, 914
suillus	601
sujef	766
Sukkegh Salmon	308
summulentus	632
Sun-fish	453, 462, 472, 482, 865
Sunny	482
superciliosus (Aspidophorus)	723
(Hexagrammus)	644
(Hyborhynchus)	160
(Labrax)	644
Surf-fish	585, 592, 594, 595
Surf Smelt	294
Whiting	577, 933
Surgeon	616
Surgeon-fish	617
surinamensis	555
surmuletus	565
Surmullet	564, 565
sutor	439
swampinus	332
swani	729
Swell-shark	59
Swell-toad	861, 863
Swingle-tail	27
Sword-fish	420
symmetricus (Caranx)	432, 911
(Ceratichthys)	213
(Lepomis)	473
(Leucosomus)	213
(Pogonichthys)	213
(Trachurus)	432
Symmetrurus	222
synagris	922
Synaphobranchidæ	364
Synaphobranchus	364
Synentognathi	371
Syngnathidæ	382
Syngnathus	382
Synodus	279, 280, 889
Syrrhina	63, 876
syrtensium	295

T.

tabaccaria	389
tænia (Blennius)	766
(Clinostomus)	234
(Murænoides	766
(Squalius)	234
tæniatus	552
tæniops	919
tæniopterus	704
Tæniotoca	594
tahoënsis	127
Tailor Herring	266
Tambor	860
tapdisma	309
Tarpum	261, 262
tau	750, 751
Tauridea	694
taurocephala	166
Tautog	600, 936
Tautoga	599, 936
tautoga	599
Tautogolabrus	599
taylori	793
tchawytcha	307, 890
telescopus	201
Telestes	230
Telipomis	473
temmincki	586, 594
Temnistia	714
Temnodon	448
tenellus	340
tenuis (Atherinopsis)	405, 406
(Gadus)	799
(Leuresthes)	405
(Phycis)	799
teres (Alosa)	263
(Catostomus)	130
(Cœcula)	897
(Cyprinus)	130
(Etrumeus)	263
(Sphagebranchus)	897
Teretulus	136
teretulus	205
tergisus	260
terræ-novæ	24, 25
tessellata (Etheostoma)	509
Tesselated Darter	492
tessellatum (Boleosoma)	492
(Nanostoma)	511
tessellatus (Hadropterus)	511
(Nothonotus)	509
testudineus	861
Tétard	631
Tetragonopterus	255
Tetragonoptrus	614

	Page.
tetrapturorum	418
Tetrapturus	420
Tetrodon	860, 966
Tetrodontidæ	859
Teuthydidæ	616, 880
texana (Anguilla)	361
(Cyprinella)	178
texensis (Dionda)	157
(Cynoscion)	581
thalassinum (Moxostoma)	139
(Nanostoma)	511
thalassinus (Lepidogobius)	947
(Nothonotus)	511
(Otolithus)	581
(Ptychostomus)	139
Thaleichthys	291
thaleichthys	292
thazard	911
thompsoni (Carpiodes)	119
(Ictiobus)	883
(Triglopsis)	709, 710
thoreauianus	221
Thread-fin	412
Thread-fish	438
Thread Herring	268
Thresher Shark	26, 27
thrissa	268, 269
thrissoides	262, 887
Thunder-pumper	567
thunnina	430
Thymallus	302
thymallus	302
Thynnichthys	429
Thynnus	428, 429
thynnus	429
Thyris	840
Tiaroga	163
tiburo	25, 26, 874
Tiger Sharks	21
Tigoma	230, 233
tigrinus (Galeocerdo)	21, 60
(Myrichthys)	360
Tile-fish	624
Tilesia	804
tilesii	715
timpanogensis	196
timucu	902
tincellus	245
Tiphle	382
Tirodon	968
Toad-fish	750, 845
Tobacco-box	40
tobianus	414, 415, 909
Togue	317
toma	317
Tom-cod	805, 806
tom-cod	806
tomcodus	806
Toothed Herring	260
Top Minnow	338
Tope	21
Torpedinidæ	38
Torpedo	38, 39, 876, 877
torpedo (Raia)	38
torvus	688
Toter	130
toxotes	596
Trachinidæ	623, 624, 627, 628, 880
Trachinocephalus	281
Trachurops	433, 970
Trachurus	431, 911
trachurus (Caranx)	432, 911
(Cottus)	715
(Gasterosteus)	395, 396
(Hemilepidotus)	715
(Scomber)	432, 912
(Trachurus)	432, 912
Trachynotus	441
Trachypteridæ	617
Trachypterus	618
tractus	941
tranquebar	724
transmontanus (Acipenser)	86
(Rhinichthys	207, 885
traski	587
Tree-fish	676
triacanthus	451
Triacis	20, 870
tribulus	735
Trichidion	413
Trichiuridæ	421, 910
Trichiurus	422
trichocephalus	862
Trichodiodon	862
Trichodon	627
trichodon	627
Trichodontidæ	626, 880
trichroistia	181
tricolor (Chætodon)	615
(Holacanthus)	941
(Pomacanthus)	941
(Thymallus)	303
tricuspis	708, 709
tridentatus	7, 8, 57, 867, 868
tridigitatus	753
trifurcus	534, 917, 973
Trigger fish	854
Trigla	733, 956
Triglidæ	640, 651, 731, 880
Triglops	712
Triglopsis	709
trigonum	853
trigrammus	644
Triloburus	534
trilobus	720
triqueter	966
triquetrum	965
triserialis	359, 897, 898
triseriatus	64, 65, 876
Trisotropis	537, 918, 919, 971
trispinosa (Corvina)	570, 931
trispinosus (Odontopyxis)	729
tristœchus	92
trivittatus	554
Trochocopus	601, 936
tropica (Echeneis)	970
tropicus (Atractosteus)	92
Trout Perch	322
trowbridgii (Abeona)	588
(Homalopomus)	809

	Page.
Trumpet-fish	388, 389
truncata (Belone)	374
truncatus (Orthagoriscus)	967
(Ranzania)	966
(Salmo)	313, 314
(Tetrodon)	967
Trunk-fish	852
Trycherodon	247
Trygon	47, 879
Trygonidæ	45
Trygonorhina	876
tsuppitch	308, 315, 316
tschawytscha	890
tuberculatus	48, 49, 66, 879
tudes	320
tuditana	165, 166
Tullibee	301
tullibee	301, 302
tumidus	118, 119, 883
Tuna	428
tunicata	741, 742
Tunnies	428, 429
Tunny	429
Turbot	815, 830
turgidus	861, 862
turneri	788
Tyee Salmon	306
Tylosurus	372, 901
Tyntlastes	639
Typhlichthys	324
Typhlogobius	639
typicus	187
tyrannus (Alosa)	267
(Anguilla)	361
(Brevoortia)	269
(Clupea)	270

U.

Ulocentra	494
Umbla	816
Umbra	350
umbra	569
umbratilis	200
Umbridæ	349
Umbrina	575
umbrosa (Cliola)	176
(Cyprinella)	176
(Lepidopsetta)	832
umbrosus (Esox)	352, 894
(Platichthys)	834
(Pleuronectes)	831
(Sebastichthys)	950
(Sebastodes)	950
uncinatus	693
undecimalis	528
undulata (Umbrina)	576
undulatus (Menticirrus)	578, 932, 933
(Micropogon)	575
unicolor (Ammocœtes)	868
(Bryttus)	477
unicornis	818
unifasciatus	376
unimaculatus (Argyreiosus)	440
(Clinus)	775
(Stichæus)	775
uninotatus	922
Upeneus	565
Upselonphorus	628
Uranidea	693, 953, 954, 955
uranops (Phenacobius)	206
Uranoscopidæ	627
uranoscopus (Mancalias)	848
uranoscopus	848
Urolophus	46
Uronectes	789
Urophycis	798
Uropsetta	821
urus	116, 883
ustus (Calliodon)	606
utah	315

V.

vacca	597
vagrans	407, 908, 969
vahli	786, 787
Vaillantia	493
vampyrus	53
vandoisulus	232
variabilis (Acanthocottus)	703
(Perca)	659, 950
(Sebastes)	659
variatum (Etheostoma)	503
variatus (Alvordius)	503
(Pœcilichthys)	518
variegatus (Cyprinodon)	329, 890
(Limnurgus)	343
velatum	138
veliana	405
velifer (Carpiodes)	120
(Ictiobus)	120
(Letharchus)	896
velox	166
ventralis	708
ventricosa (Apocope)	211
(Temnistia)	715
ventricosus (Blepsias)	715
(Ceratichthys)	211
(Cyclopterichthys)	745
(Cyclopterus)	745
ventriosus (Scylliorhinus)	59, 869
venusta (Cliola)	178
(Cyprinella)	178
(Limia)	343
(Lucania)	343, 893
vermicularis (Sparus)	922
vermiculatus (Xyrichthys)	605, 973
vernalis (Clupea)	267
(Gobio)	214
(Pomolobus)	267
(Scomber)	424
verrilli	786
verrucosus (Brachyopsis)	726
(Cottus)	707
(Leptagonus)	955
versicolor (Abramis)	250
(Argyrops)	929
(Labrus)	929
(Stenotomus)	929
verticalis	829
verus	875

	Page.
vespertilio (Holorhinus)	51
(Malthe)	850
(Rhinoptera)	51
vetulus (Balistes)	855
(Parophrys)	832
(Pleuronectes)	831
vexillare (Boleosoma)	493
vexillaris	672, 673
vheeleri	697
Vieja Muger	938
vigilax	169
vigilis	971
villosa (Clupea)	291
villosus (Cottus)	686
(Mallotus)	291
vinctipes	510
viola	800
violaceum (Ditrema)	586, 936
violaceus (Apodichthys)	774
(Cebedichthys)	774, 962
Viper-fish	284
virens	806
virescens (Apodichthys)	770
(Pantosteus)	124
virgatulus	957
virgatus (Delolepis)	779
(Pœcilichthys)	515
virginalis	315
virginicum (Pristipoma)	552
virginicus (Anisotremus)	552
(Pomadasys)	552, 923
(Sparus)	552
virginianus (Acanthocottus)	701
viride (Ophidium)	789
viridis (Centrarchus)	468
(Centropomus)	528
(Chænobryttus)	468
(Esox)	92, 880
(Gymnelis)	789
(Lepidosteus)	92
viridescens (Syngnathus)	383
(Osmerus)	293
viscosa	698
vitrea (Ioa)	490
(Perca)	525
vitreum (Stizostedium)	525
vitreus (Pœcilichthys)	491
vittata (Argyrotænia)	415, 909
(Cliola)	172
(Clupea)	273
(Codoma)	172, 173
(Hemitremia)	162
(Lepidomeda)	252
vittatus (Ammodytes)	415
(Engraulis)	273, 888
(Esox)	352, 894
Viuva	660
vivax (Ammocrypta)	169, 970
(Cliola)	169
viviparus	652
Volador	378, 738
volitans (Cephalacanthus)	957
(Dactylopterus)	738
(Exocœtus)	378
(Trigla)	738
volucella	168
Vomer	439, 440
vomer	439, 440
vomerinus	781
vorax	229
vulgaris (Acanthias)	17
(Amiurus)	105
(Anguilla)	361
(Auxis)	425
(Belone)	372
(Brosmius)	803
(Carcharias)	873
(Carcharinus)	873
(Conger)	363
(Hippoglossus)	819
(Liparis)	742
(Lota)	802
(Merlucius)	809
(Molva)	801
(Mustelus)	19, 20
(Pagrus)	556
(Pimelodus)	105
(Pomotis)	483
(Sphyræna)	411
(Thynnus)	429
vulnerata (Apocope)	210
vulneratus (Nothonotus)	508
(Pœcilichthys)	509
vulpes (Albula)	258
(Alopecias)	27
(Alopias)	27
(Esox)	258
(Pimelodus)	109
(Squalus)	27
vulsus	730
W.	
wachna	805
Wall-eyed Perch	591
Pike	525
War-mouth	467, 468
warreni (Boleichthys)	521
(Pœcilichthys)	521
(Salmo)	309
Warsaw	920
Weak-fish	579, 581
webbi (Blennophis)	756
(Embiotoca)	595
(Ophioblennius)	756
wheatlandi	395
wheeleri	697
whipplei (Boleichthys)	516
(Cliola)	178
(Cyprinella)	178
White Angel	940
Whitebait	265
White Bass	529
Cat	107, 108
White-fish	269, 296, 625
White Grunt	554
Hake	799
Mullet	139, 403
Perch	530, 567, 591, 597
Sturgeon	86, 88
Sucker	129, 140

	Page.
White Trout	580
Whiting	299, 577
williamsoni (Coregonus)	297, 968
(Gasterosteus)	394
wilsoni	697
winchelli	214
Window-pane	815
Winter-Flounder	837
Winter Salmon	306
Wolf-fish	781
Wrasse-fishes	597
Wreck-fish	532
Wry-mouth	780
würdemanni	634, 945

X.

xænocephalus	192
xænura	184
xanthocephalus	104
xanthurus (Homoprion)	571, 932
(Liostomus)	574, 932
(Rhombus)	914
(Sciæna)	574
(Seserinus)	914
xanti	576
Xenichthyinæ	546
Xenichthys	546, 920
xenicus	891, 892
Xenisma	331, 336
Xenistius	920
Xenotis	472, 477
Xiphias	419
Xiphidion	771
Xiphidiontidæ	754
Xiphiidæ	419, 909
Xiphister	771
Xiphisterinæ	754
Xiphophorus	346
xyosternus	727, 955
Xyrichthys	605
Xystreurys	821, 825
Xystroplites	472, 480

Y.

Yellow Bass	530
Cat	102, 105
Yellow Cavallé	440
Yellow-finned Roncador	576
Yellow Perch	524
Pike	525
Yellow-tail	269, 444, 446, 570, 625, 657
Yelting	54
y-græcum	628, 629, 941

Z.

zachirus	838
zanemus	217
Zaniolepis	647
Zapteryx	876
zatropis	905, 906
zebra (Fundulus)	333, 335, 336, 891
(Gerres)	935
(Hydrargyra)	333, 335
zebrinus	891
Zenidæ	456
Zenopsis	456
Zoarces	784
Zoarcidæ	783
zonale	510
zonata (Cliola)	183
(Seriola)	445, 913
zonatum (Elassoma)	461, 915
zonatus (Alburnus)	183
(Ephippus)	614
(Esox)	342
(Fundulus)	342
(Haplochilus)	342
(Leuciscus)	183
(Scomber)	445
(Zygonectes)	341, 342
Zonichthys	446
zonifer	649
zonistius	180, 188, 189
Zophendum	154
zophera	697
zosteræ	907
zunnensis	229
Zygæna	26
zygæna	26, 61
Zygonectes	338, 892, 894
zyopterus	870

69 pag, 6 pl, 2 fg.

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